Mean Annual Renewable Water Supply of the Contiguous United States

Thomas C. Brown and Pamela Froemke
Rocky Mountain Research Station, U.S. Forest Service, Fort Collins, Colorado

Vinod Mahat and Jorge A. Ramirez
Colorado State University, Fort Collins

23 January 2016

Our fresh water supply begins as precipitation falling on land and fresh waters. From there the water naturally evaporates from the land or vegetation, percolates down to groundwater aquifers, or flows toward sea via rivers and streams. Water that evaporates is unavailable for use until it falls again elsewhere as precipitation. What remains is—until it reaches the sea—available for use by humans and other species, and in a broad sense is our renewable fresh water supply.

We estimated water supply across the contiguous 48 states for the period 1981-2010. Political, administrative, watershed, and land cover boundaries then were mapped over the gridded water supply estimates to indicate the amount of water supply that originates in an average year in respective land areas. The estimates focus on the contribution of forests and public lands, with special attention to wilderness areas. These water supply estimates are an update of those provided in Brown et al. (2008) and in two related reports posted online in 2009: "Estimated mean annual contribution to water supply from units of the National Forest System (NFS) of the U.S. Forest Service," September 2009; and "Estimated mean annual contribution to water supply from designated wilderness in the coterminous United States," October 2009. Compared with these earlier papers, these new estimates incorporate more recent precipitation and temperature data, apply a different water yield model, and utilize more and newer land cover and land ownership data.

Methods

Daily water yield was estimated using the Variable Infiltration Capacity (VIC) model at each 1/8º by 1/8º (about 12 km by 12 km) grid cell across the conterminous U.S. Yields were aggregated over time to estimate mean annual yield. Having the spatially distributed estimates of mean annual water yield at its source, land boundaries were then overlaid. Aggregating estimates of yield across cells within a boundary indicates the amount of water supply originating within the designated area.

Water yield model

The VIC model (Cherkauer et al., 2003; Liang et al., 1994; Liang et al., 1996; Nijssen et al., 1997) is a semi-distributed, macro-scale, grid-based hydrological model that solves the vertical energy and water balances in each grid cell. The model has been applied to many basins in the United States, including California's Central Valley (Brekke et al., 2008; Cayan et al., 2010), the

Colorado River Basin (Christensen and Lettenmaier, 2007), the Columbia River Basin (Hamlet et al., 2010), and several other basins in the U.S. (Maurer et al., 2002) and elsewhere (Lohmann et al., 1998).

The VIC model allows for sub grid-scale heterogeneity of land surface properties (e.g., vegetation class, soil type, etc.) and of fluxes and storages (e.g., soil moisture storage, evaporation, runoff production, etc.). Vegetation characteristics are assigned for each vegetation class, including leaf area index (LAI), albedo, stomatal resistance, roughness length, relative fraction of roots in each soil layer, and displacement length.

Three soil layers are recognized in the VIC model. Surface runoff is generated from the upper two soil layers using a variable infiltration curve considering both infiltration excess and saturation excess, and base flow is produced from the bottom layer as a nonlinear function of soil moisture in the layer. Water yield is simulated as the superposition of surface runoff and base flow. The model uses gridded daily precipitation, minimum and maximum temperatures, and wind speed, along with gridded land surface and soil data, to simulate daily soil moisture, base flow and surface runoff among other fluxes and storages.

Climatic forcings (precipitation, minimum and maximum temperatures, and wind speed) and other inputs (soil properties, vegetation and snow albedo data) for the historical period (1981-2010) required to run the VIC model at the 1/8º x 1/8º grid scale for the contiguous U.S. were obtained from the Surface Water Modeling group at the University of Washington (http://www.hydro.washington.edu/Lettenmaier/Data/gridded/).

Beginning with a version of the model calibrated by Maurer et al. (2002) at the Water Resources Region (WRR) scale, we further calibrated the model at the Assessment Sub-region (ASR) spatial scale (Figure 1). The 98 ASRs of the contiguous U.S. are subdivisions of the 18 WRRs, and were first delineated by the U.S. Water Resources Council (1978). ASRs have been used in two recent assessments of the effects of climate change on U.S. water supply (Blanc et al., 2014; Foti et al., 2014). For the calibration, independent estimates of annual water yield of the ASRs were developed for the period 1953-2005 from the following three data sources using methods outlined by Foti et al. (2012):

Figure 1. Water Resource Regions and Assessment Sub-regions of the contiguous U.S.

- A 42-year (1953-1994) series of annual streamflow records for 655 relatively unmodified test basins across the U.S (Hobbins et al., 2001; Slack and Landwehr, 1992).
- Reconstructed natural streamflow estimates for years 1906-2006 for a set of watersheds in the Colorado River Basin, provided by the U.S. Bureau of Reclamation.
- 30-year average reconstructed natural streamflow for the 8-digit basins (HUC-8) of the U.S. estimated by the U.S. Geological Survey (Krug et al., 1989).

Data of the 655 test basins were used to estimate annual water yields where possible; 8-digit basin data, supplemented by the Bureau of Reclamation estimates, were used where data from the test basins were not available. The test basins were preferred because they are relatively unaffected by human intervention, thereby avoiding the need for natural flow reconstruction. Hereafter, these estimated water yields are referred to as "observed" water yields.

We recalibrated the model for each ASR by adjusting soil depths only (adjusting other parameters did not help to significantly reduce the observed bias). Remaining differences between the observed and simulated mean annual water yields range among the ASRs from -10 mm to 6 mm. These biases are less than 4% of the U.S. average observed historical flow of about 300 mm. See Mahat et al. (2015) for more detail on the calibration.

The VIC model was implemented at a daily time-step over the period 1981-2010 for the entire contiguous U.S. Estimates of yield by cell were aggregated temporarily to the annual time step, and the annual estimates were then averaged over the 30-year period.

Land designations

We report land area and associated water supply for alternative political, hydrologic, administrative, and land cover units of the contiguous U.S.

Political units

Results are presented by state and by groups of states called regions. Five regions were defined, as follows:

- **East**: CT, DC, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VT
- **South**: AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, VA, WV
- **Midwest**: IA, IL, IN, MI, MN, MO, OH, WI
- **Plains**: KS, ND, NE, OK, SD, TX
- **West**: AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY.

Official boundaries of some states extend into major water bodies, such as the Great Lakes (e.g., Wisconsin) or major bays and estuaries (e.g., Washington). In these cases we clipped state boundaries at the water's edge.

Hydrologic units

Some results are presented by Water Resource Region (Figure 1).

Administrative units

Land management boundaries were taken from three sources. First, federal land administration was distinguished from non-federal (state and private) administration based on boundaries taken from the 2005 Federal Lands of the United States database of the National Atlas of the U.S. (http://nationalatlas.gov/atlasftp.html) at the 100-m grid spatial resolution. Four categories of federal ownership (Forest Service, Park Service, Bureau of Land Management, and other) were tracked. This database contains U.S. Forest Service proclamation boundaries, which include some adjacent private land. All land not specified as federal in this database was lumped into the "state and private" category, which includes Indian reservations.

Second, land ownership boundaries of the National Forest System were taken from the "U.S. Forest Service Surface Ownership Parcels" database, dated November 11, 2015 (https://catalog.data.gov/dataset/u-s-forest-service-basic-ownership). These boundaries do not include adjacent private land.

Third, wilderness area boundaries for the various federal agencies were obtained from the Wilderness Institute at the University of Montana's College of Forestry and Conservation, dated October 12, 2015 (http://www.wilderness.net/NWPS/geography).

Land cover

Land cover was taken from two primary sources, the 2006 National Land Cover Database (NLCD) (Fry et al., 2011) (http://www.mrlc.gov/nlcd06_data.php.at) and the 2012 (lf 1.3.0) LandFire release (http://www.landfire.gov/NationalProductDescriptions21.php). Data from each database are available at the 30-m grid spatial resolution. These data were then resampled to the 100-m grid spatial resolution. Five cover classes were formed from each database. For the NLCD, the following classes were formed from the original 16 classes with data for the contiguous U.S.:

- **Forest**: deciduous forest (41), evergreen forest (42), mixed forest (43)
- **Rangeland**: shrub/scrub (shrubland) (52), grasslands/herbaceous (herbaceous) (71)
- **Agriculture**: pasture/hay (81), cultivated crops (82)
- **Developed**: developed, open space (21), developed, low intensity (22), developed, medium intensity (23), developed, high intensity (24)
- **Riparian**: woody wetlands (90), emergent herbaceous wetlands (95)
- **Other**: bare rock/sand/clay (31), open water (11), perennial ice/snow (12).

Of the several cover classifications provided by LandFire, we used the EVT_PHYS (Physiognomy) data. To reduce the data to six classes similar to the NLCD groupings, we used the existing vegetation system group (EVT_GP) to apportion the Exotic tree-shrub and Exotic herbaceous EVT_PHYS classes. The following classes were formed from the original 20 EVT_PHYS classes containing data for the contiguous United States:

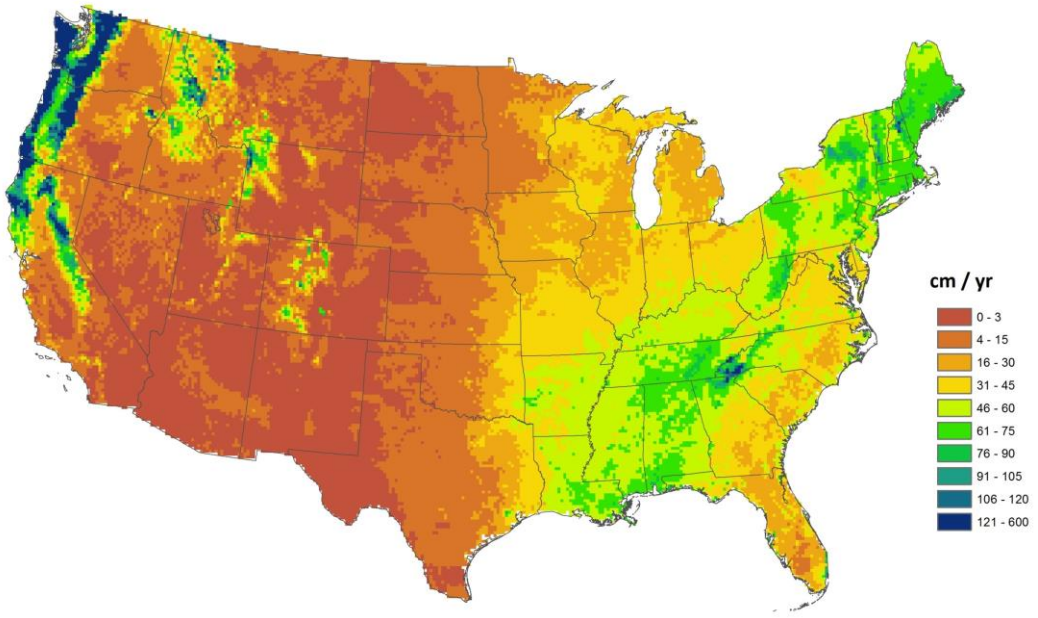
- **Forest**: Conifer, Conifer-hardwood, Hardwood, Hardwood-conifer, Exotic tree-shrub if EVT_GP = 707.
- **Rangeland**: Grassland, Shrubland, Exotic herbaceous if EVT_GP = 702, 703, or 704.
- **Agriculture**: Agricultural
- **Developed**: Developed, Developed-roads, Developed-high intensity, Developed-medium intensity, Developed-low intensity.
- **Riparian**: Riparian, Exotic tree-shrub if EVT_GP = 701 or 705, Exotic herbaceous if EVT_GP = 709.
- **Other**: Barren, Quarries-strip mines-gravel pits, Snow-ice, Sparsely vegetated, Open water.

In addition, we used the 2008 U.S. Forest Service's Forest Inventory and Analysis (FIA) forest cover data (http://data.fs.usda.gov/geodata/rastergateway/biomass/) available at the 250-m grid spatial resolution.

Results

Mean annual 1981-2010 water yield depths for the contiguous U.S. estimated using the VIC model are shown in Figure 2. In the West the highest yields are concentrated in the mountainous areas of the north Pacific Coast, the Sierras of California, and the northern and central Rocky Mountains. Away from these mountains areas mean annual yields tend to be ≤ 15 cm/y. Yields are uniformly ≤ 15 cm/y in the Great Plains and Southwest. Yields east of the Great Plains tend to exceed 30 cm/y except for areas along the eastern edge of the Great Plains, some areas near the Great Lakes, and areas along the south Atlantic coast including Florida.

Figure 2. Mean annual water yield depth.

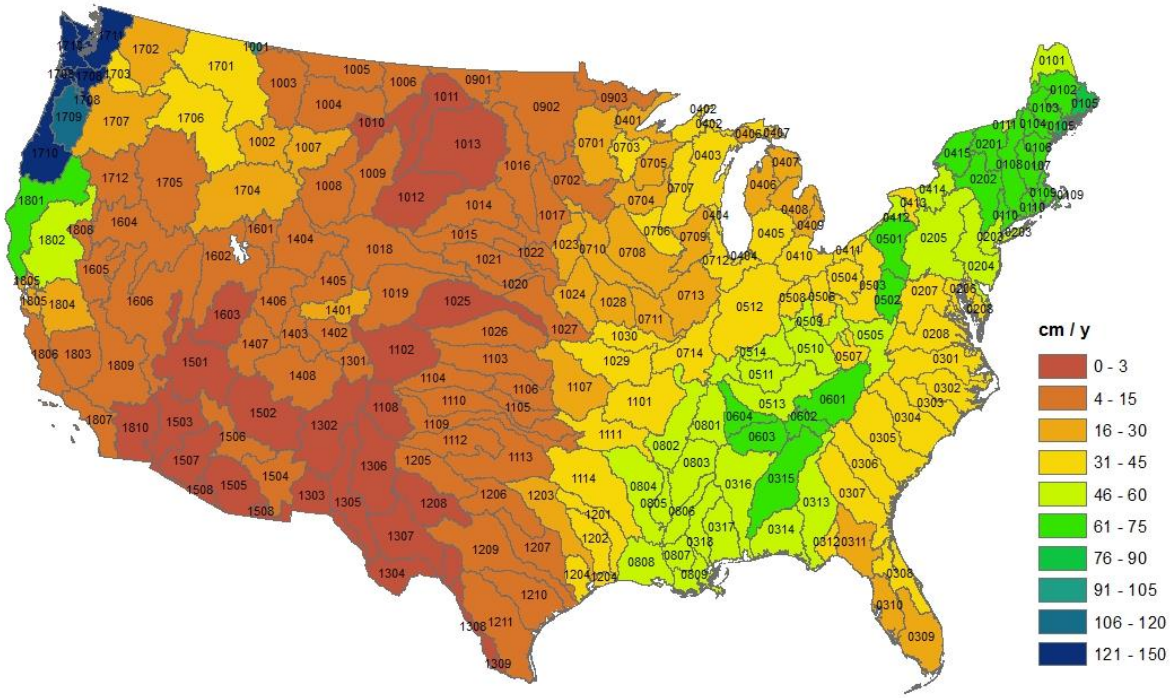


A summary at the 4-digit hydrologic unit level (Figure 3) shows mean annual yield ranging from <1 cm/y (HUCs 1108, 1502, 1503, 1507, 1508, and 1810) to >100 cm/y (HUCs 1708, 1709, 1710, and 1711). Across all 204 HUCs, the mean and median annual yields are 30 and 29 cm/y, respectively.

Water supply volumes and area estimates by land ownership and land cover are summarized below in three subsections: (1) by land ownership/administration and land cover type for the contiguous U.S. as a whole and by major region of the U.S.; (2) for units administered by the U.S. Forest Service; and (3) for designated wilderness areas.

In addition, the appendices contain a total of 43 tables giving more detail on land area and contribution to water supply. Estimates are provided by state, water resource region, NFS region, and NFS unit.

Figure 3. Mean annual water yield depth by 4-digit HUC.



Land area and water supply by federal agency and cover type

National-level estimates

Federal land, as reported in the National Atlas, occupies 24% of the contiguous U.S. and yields 23% of its mean annual water supply (Table 1). Federal agencies differ greatly in terms of water supply, because of differences in amount of land they manage and in the elevation and rainfall that occur on those lands. For example, Forest Service lands yield 18% of the water supply from 11% of the land area whereas BLM lands yield 2% of the water supply from 9% of the land area (Table 1). See Appendix A for results in volumetric units.

Based on NLCD land cover data, forests occupy 26% of the land area of the contiguous U.S. but yield 46% of the mean annual water supply, whereas rangelands occupy 37% of the land but yield only 14% of the water supply (Table 2). Notably, results by land cover depend on which land cover data are used, which in turn reflects the different definitions

Table 1. Percent of land and water supply by land ownership type and region.

	E	S	M	P	W	All
	Percent of land*					
FS	2	7	6	2	21	11
BLM	0	0	0	0	23	9
NPS	0	1	0	0	3	1
Other fed.	1	2	1	1	4	2
S&P	97	90	93	96	50	76
	Percent of mean annual water supply					
FS	3	8	6	3	49	18
BLM	0	0	0	0	6	2
NPS	0	1	0	0	6	2
Other fed.	1	2	1	2	1	1
S&P	97	89	93	96	37	77

E = East, S = South, M = Midwest, P = Plains, W = West, FS = Forest Service, BLM = Bureau of Land Management, NPS = National Park Service, Other federal = all other federal agencies.
* 2005 Federal land designations taken from the Federal Lands of the United States database of the National Atlas of the U.S.

used to distinguish among cover types. In contrast to the NLCD land cover data, with the Landfire PHYS land cover data forests occupy 29% of the land and provide 50% of the water supply, whereas rangelands occupy 30% of the land and provide 7% of the water supply (Table 3). Further, based on the FIA cover data, forests occupy 34% of the land and provide 59% of the water supply (see Appendix E for more detail).

Regional-level estimates

In all regions but the West, the great majority of the land is in private (or state) ownership. Percentages of land in federal ownership are as follows: 3, 10, 7, 4, and 50 in the East, South, Midwest, Plains, and West, respectively (Table 1). Percentages of the water supply originating on federal land roughly match the percentages of the land in federal ownership except in the West, where much of the high country is in national forests or parks. The following percentages of water supply originate on federal lands: 3, 11, 7, 4, and 63 in the East, South, Midwest, Plains, and West, respectively (Table 1, Figure 4).

Across the regions, forests occupy from 8% (Plains) to 58% (East) of the land based on NLCD designations, and yield from 19% (Plains) to 60% (East) of the water supply (Table 2, Figure 4). The percentages of water supply roughly match the percentages of land by cover type except for the Plains and West regions, where, for the regions as a whole, forests are disproportionally important and rangelands are relatively unimportant. For example, in the West forests are the source of 58% of the water supply but occupy only 23% of the land. The relative roles of forests and rangelands in yielding water supply in the Plains and West reflect the dryness of much of the western rangeland areas versus the relatively high rainfall of their forest areas.

Table 2. Percent of land and water supply by NLCD cover type and region.

	E	S	M	P	W	All
	Percent of land					
Forest	58	44	25	8	23	26
Rangeland	4	9	3	49	62	37
Agriculture	17	23	52	33	8	23
Developed	11	9	9	5	3	6
Riparian	7	14	8	3	1	5
Other	3	3	3	2	3	3
	Percent of mean annual water supply					
Forest	60	46	28	19	58	46
Rangeland	4	8	3	31	30	14
Agriculture	15	22	50	35	4	22
Developed	11	9	10	8	3	8
Riparian	7	12	7	5	1	7
Other	3	3	2	2	4	3

E = East, S = South, M = Midwest, P = Plains, W = West.

Table 3. Percent land area in forest and water volume from forests, by region and cover data source.

	E	S	M	P	W	All
	Percent of all land					
NLCD	58	44	25	8	23	26
LandFire	60	50	27	11	27	29
FIA	66	66	28	11	30	34
	Percent of total mean annual water supply					
NLCD	60	46	28	19	58	46
LandFire	62	51	30	22	64	50
FIA	69	66	30	27	75	59

See notes to Table 1. LandFire = EVT_PHYS classes.

The role of forests in the West rises in importance if other land cover data are used. Using the LandFire PHYS designations, forests cover 27% of the land area and yield 64% of the water supply, whereas using FIA data forests cover 30% of the land area and yield 75% of the water supply (Table 3).

Among the three sources of forest cover data, the NLCD data indicate the smallest amount of forest area in all regions (Figure 5). The FIA data indicate the greatest amount of forest area in

all regions except the Plains, where the LandFire data indicate the most forest cover. In all regions, NLCD indicates the least amount of water supply originating in forests and FIA indicates the most water originating in forests.

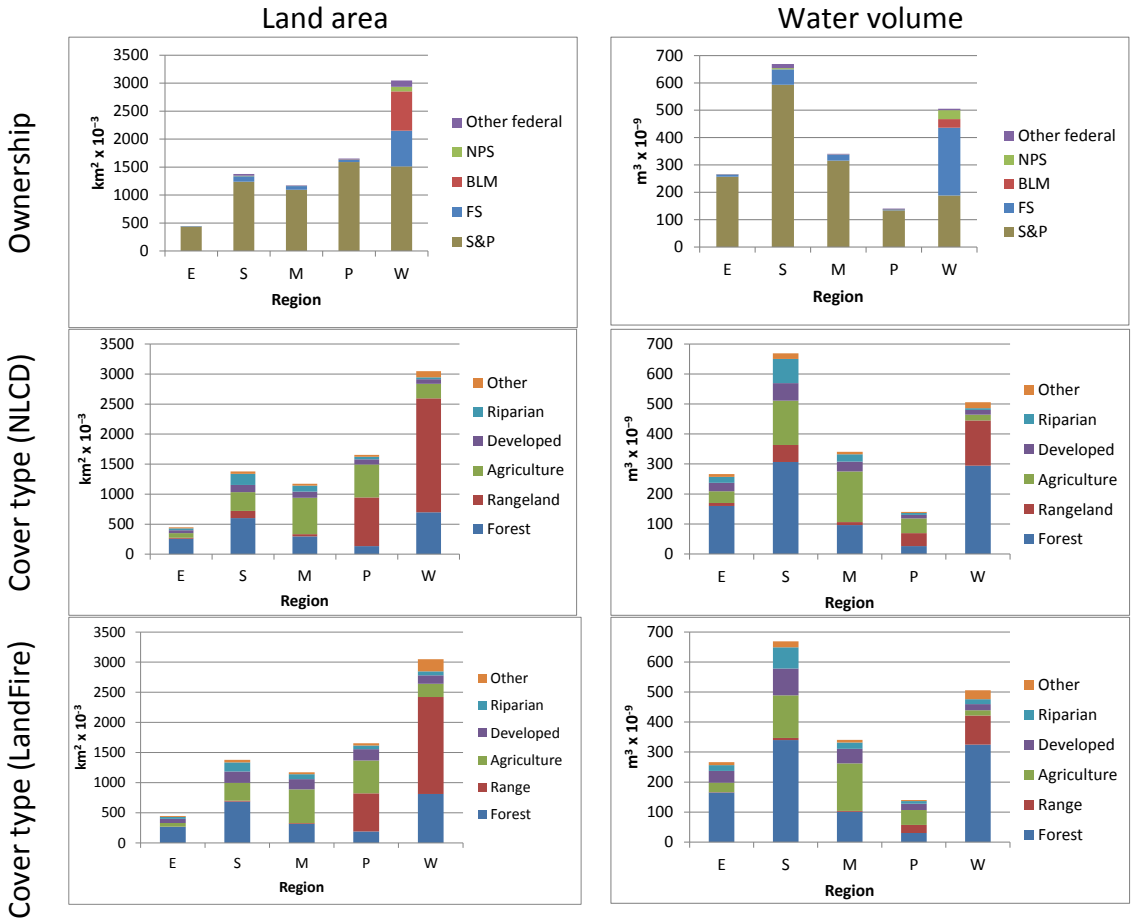
As reported above, the three cover type data layers—those from NLCD, LandFire PHYS, and FIA—are not always in agreement about the location of forest cover. They may differ in many ways depending on location, but when examining the differences some general patterns emerge. Those general patterns are summarized by region in Table 4. Typically the greater forest area of FIA than of LandFire/PHYS, and the greater forest area of LandFire/PHYS than of NLCD, is due to classification of range or riparian pixels as forest.

Table 4. Major discrepancies among the three estimates of forest area.

Region	Forest in LandFire/PHYS but as follows in NLCD	Forest in FIA but as follows in LandFire/PHYS
East	Range	Riparian
South	Riparian especially in Southeast Coastal region; Range and riparian further north and inland	Riparian
Midwest	Riparian in the northern states; riparian and range elsewhere	Riparian, mostly in the northern states
Plains	Range, especially in central Texas	Agriculture and range generally, with some riparian in Texas*
West	Range	Range

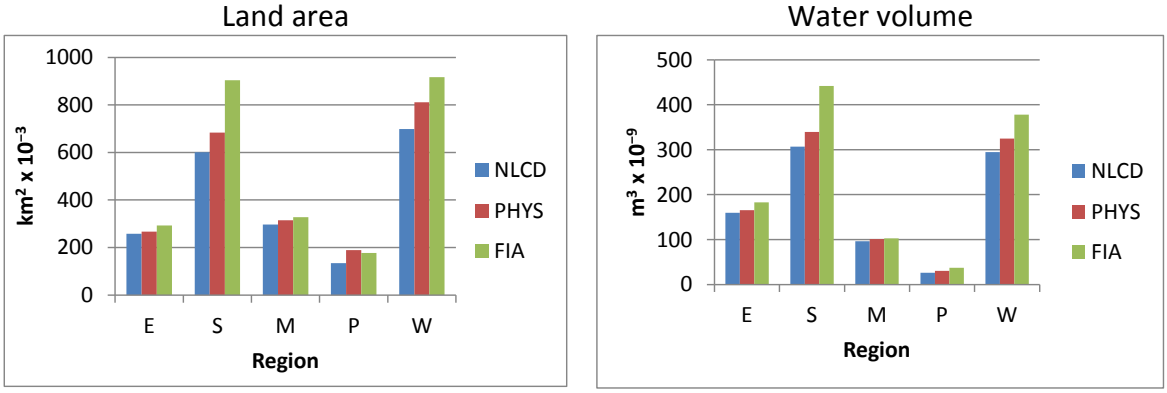
* LandFire/PHYS forest area exceeds FIA forest area in the Plains region. The FIA forest pixels that are not also LandFire/PHYS forest are generally LandFire/PHYS riparian and located in eastern Oklahoma and Texas.

Figure 4. Regional land area and water supply by land ownership and cover



E = East, S = South, M = Midwest, P = Plains, W = West.

Figure 5. Forest land area and water volume by region and cover data



E = East, S = South, M = Midwest, P = Plains, W = West, PHYS = LandFire EVT_PHYS classes.

Land area and water supply of the National Forest System

Recent estimates from the Forest Service of the land area of the National Forest System (NFS) indicate that over the contiguous U.S. the NFS occupies about 693 thousand km^2, which is 82% of the NSF administrative (proclamation) boundary area of 845 thousand km^2 (Table 5). The NFS provides an annual average of 280 billion m^3 of water yield, equal to 83% of the yield from the larger administrative area. See Appendix F for estimates at the state and NFS unit level.

Table 5. National Forest System land area according to two area designations, and associated mean annual water supply volume, by region of the contiguous U.S.*

Region	Land area ($km^2 \times 10^{-3}$)		Water volume per year ($m^3 \times 10^{-9}$)	
	Proclamation	Ownership	Proclamation	Ownership
East	9	7	7	6
South	96	54	56	31
Midwest	66	38	21	12
Plains	38	21	4	2
West	637	573	248	230
U.S.	845	693	337	280

* NFS proclamation boundaries taken from the 2005 Federal Lands of the United States database of the National Atlas of the U.S. NFS land ownership boundaries taken from the November 2015 U.S. Forest Service Surface Ownership Parcels database.

Land area and water supply of wilderness areas

Designated wilderness in the contiguous U.S. occupies about 212 thousand km^2, of which 59% is on national forests, 20% is on national parks, and 17% is on BLM land (Table 6). See Appendix G for more detail.

Within the NFS, designated wilderness occupies 18% of the land and provides 25% of the contribution to water supply (Table 7). Looking at the West alone, where most of the national forest and wilderness lands are found, wilderness occupies 20% of the land and provides 29% of the contribution to water supply.

Table 6. Wilderness land area and associated mean annual water supply volume, by federal agency and region of the contiguous U.S.

Region	Land area (km^2)*					Water volume per year ($m^3 \times 10^{-6}$)				
	FS	BLM	NPS	FWS	Total	FS	BLM	NPS	FWS	Total
East	1,050	0	0	65	1,115	1,109	0	0	39	1,148
South	3,336	0	3,757	1,684	8,777	2,227	0	1,204	721	4,153
Midwest	5,426	0	719	187	6,332	1,119	0	240	63	1,421
Plains	306	0	559	98	963	93	0	8	3	104
West	115,691	36,598	36,676	6,010	194,975	65,898	1,614	20,130	120	87,762
U.S.	125,809	36,598	41,711	8,044	212,162	70,447	1,614	21,582	946	94,588

* Based on data from the Wilderness Institute at the University of Montana's College of Forestry and Conservation.

Table 7. Wilderness as a percent of total NFS land area and associated mean annual water supply volume, by region of the contiguous U.S.

Region	Land area			Water volume per year		
	NFS (km^2)	NFS wilderness (km^2)	Percent wilderness	NFS ($m^3 \times 10^{-6}$)	NFS wilderness ($m^3 \times 10^{-6}$)	Percent wilderness
East	7,052	1,050	15	5,904	1,109	19
South	53,687	3,336	6	31,117	2,227	7
Midwest	38,441	5,426	14	11,722	1,119	10
Plains	20,871	306	1	1,998	93	5
West	573,035	115,691	20	229,608	65,898	29
U.S.	693,087	125,809	18	280,349	70,447	25

Closing Comments

These estimates highlight the importance of forests and public lands in the provision of renewable water supply. Forested watersheds provide roughly two-thirds of the water supply of the East and West regions, roughly half of the water supply in the South, and somewhat less than one-third of the water supply of the Midwest and Plains regions. Because forests are also generally the source of the highest quality runoff (Brown and Binkley, 1994), it is not an exaggeration to say that forests play an extremely important role in the provision of water in the United States.

Public lands provide about 60% of the water supply in the West (but much lower proportions in the other regions), and considerably more than 60% in some western states. For example, public lands provide at least 75% of the water supply in the states of Colorado, Idaho, Nevada, Utah, and Wyoming. This also is good for water quality, because public lands are partially protected from the effects of development. Furthermore, in the West nearly 30% of the water from public lands originates on wilderness areas, where effects of development are nearly always avoided. The beneficiaries of such large scale water quality protection include not only onsite water users—recreationists and those who live or work in forests or adjacent to public lands—but also water users downstream of the forests and federally protected areas, whether they rural or urban residents, farmers or industrial water users.

References

Blanc, E.; Strzepek, K.; Schlosser, A.; Jacoby, H.; Gueneau, A.; Fant, C., et al. 2014. Modeling U.S. water resources under climate change. *Earth's Future* 2: 197-224.

Brekke, L.; Dettinger, M.; Maurer, E.; Anderson, M. 2008. Significance of model credibility in estimating climate projection distributions for regional hydroclimatological risk assessments. *Climatic Change* 89(3-4): 371-394.

Brown, T. C.; Binkley, D. 1994. *Effect of management on water quality in North American forests*. General Technical Report RM-GTR-248. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Brown, T. C.; Hobbins, M. T.; Ramirez, J. A. 2008. Spatial distribution of water supply in the coterminous United States. *Journal of the American Water Resources Association* 44(6): 1474-1487.

Cayan, D. R.; Das, T.; Pierce, D. W.; Barnett, T. P.; Tyree, M.; Gershunov, A. 2010. Future dryness in the southwest US and the hydrology of the early 21st century drought. *Proceedings of the National Academy of Sciences* 107(50): 21271-21276.

Cherkauer, K. A.; Bowling, L. C.; Lettenmaier, D. P. 2003. Variable infiltration capacity cold land process model updates. *Global and Planetary Change* 38(1–2): 151-159.

Christensen, N. S.; Lettenmaier, D. P. 2007. A multimodel ensemble approach to assessment of climate change impacts on the hydrology and water resources of the Colorado River Basin. *Hydrology and Earth System Sciences* 11(4): 1417-1434.

Foti, R.; Ramirez, J. A.; Brown, T. C. 2012. *Vulnerability of U.S. water supply to shortage: a technical document supporting the Forest Service 2010 RPA Assessment*. General Technical Report RMRS-GTR-295. Fort Collins, Colorado: U.S. Forest Service, Rocky Mountain Research Station.

Foti, R.; Ramirez, J. A.; Brown, T. C. 2014. A probabilistic framework for assessing vulnerability to climate variability and change: the case of the US water supply system. *Climatic Change* 125(3-4): 413-427.

Fry, J.; Xian, G.; Jin, S.; Dewitz, J.; Homer, C.; Yang, L., et al. 2011. Completion of the 2006 National Land Cover Database for the Conterminous United States. *PE&RS* 77(9): 858-864.

Hamlet, A.; Lee, S.-Y.; Mickelson, K. B.; Elsner, M. 2010. Effects of projected climate change on energy supply and demand in the Pacific Northwest and Washington State. *Climatic Change* 102(1-2): 103-128.

Hobbins, M. T.; Ramírez, J. A.; Brown, T. C. 2001. The complementary relationship in estimation of regional evapotranspiration: An enhanced advection-aridity model. *Water Resources Research* 37(5): 1389-1403.

Krug, W. R.; Gebert, W. A.; Graczyk, D. J. 1989. *Preparation of average annual runoff map of the United States, 1951-80.* . U.S. Geological Survey Open-File Report 87-535.

Liang, X.; Lettenmaier, D. P.; Wood, E. F.; Burges, S. J. 1994. A simple hydrologically based model of land surface water and energy fluxes for general circulation models. *Journal of Geophysical Research* 99(D7): 14415-14428.

Liang, X.; Wood, E. F.; Lettenmaier, D. P. 1996. Surface Soil Moisture Parameterization of the VIC-2L Model: Evaluation and Modification. *Global and Planetary Change* 13(1996): 195-206.

Lohmann, D.; Raschke, E.; Nijssen, B.; Lettenmaier, D. P. 1998. Regional scale hydrology: I. Formulation of the VIC-2L model coupled to a routing model. *Hydrological Sciences Journal* 43(1): 131-141.

Mahat, V.; Ramirez, J. A.; Brown, T. C. 2015. 21st Century U.S. Climate in CMIP5 Simulations: Implications for Water Yield Unpublished manuscript.

Maurer, E. P.; Wood, A. W.; Adam, J. C.; Lettenmaier, D. P.; Nijssen, B. 2002. A Long-Term Hydrologically Based Dataset of Land Surface Fluxes and States for the Conterminous United States. *Journal of Climate* 15: 3237-3251.

Nijssen, B.; Lettenmaier, D. P.; Liang, X.; Wetzel, S. W.; Wood, E. F. 1997. Streamflow Simulation for Continental-Scale River Basins. *Water Resources Research* 33(4): 711-724.

Slack, J. R.; Landwehr, J. M. 1992. *Hydro-Climatic Data Network (HCDN): A USGS streamflow data set for the U.S. for the study of climate variations*. Open-File Report 92-129: U.S. Geological Survey.

U.S. Water Resources Council. 1978. *The nation's water resources*. Washington, DC: U.S. Government Printing Office.

Appendices

A. Mean Annual 1981-2010 Water Supply Volume

Table A1. Mean annual water supply of the contiguous U.S. by region and federal agency, $m^3 \times 10^{-9}$.

Table A2. Mean annual water supply of the contiguous U.S. by WRR and federal agency, $m^3 \times 10^6$.

Table A3. Mean annual water supply of the contiguous U.S. by state and federal agency, $m^3 \times 10^6$.

Table A4. Mean annual water supply of the contiguous U.S. by region and NLCD cover type, $m^3 \times 10^9$.

Table A5. Mean annual water supply of the contiguous U.S. by WRR and NLCD cover type, $m^3 \times 10^6$.

Table A6. Mean annual water supply of the contiguous U.S. by state and NLCD cover type, $m^3 \times 10^6$.

Table A7. Mean annual water supply of the contiguous U.S. by region and LandFire/PHYS cover type, $m^3 \times 10^9$.

Table A8. Mean annual water supply of the contiguous U.S. by WRR and LandFire/PHYS cover type, $m^3 \times 10^6$.

Table A9. Mean annual water supply of the contiguous U.S. by state and LandFire/PHYS cover type, $m^3 \times 10^6$.

Figure A1. Water yield by state and federal agency.

Figure A2. Water yield by state and NLCD cover class.

B. Percent of Mean Annual 1981-2010 Water Supply

Nine tables similar to those of Appendix A, but for percent of mean annual water supply instead of water supply volume.

C. Land Area

Nine tables similar to those of Appendix A, but for land area instead of water supply volume.

D. Percent of Land Area

Nine tables similar to those of Appendix A, but for percent of land area instead of water supply volume.

E. Forest Land and Water Supply

Table E1. Estimates of forest land area from three sources, and associated water supply, by region of the contiguous U.S.

Table E2. Estimates of forest land area from three sources, and associated water supply, by WRR of the contiguous U.S.

Table E1. Estimates of forest land area from three sources, and associated water supply, by state in the contiguous U.S.

F. Mean Annual 1981-2010 Water Supply and Land Area of the National Forest System

Table F1. National Forest System ownership land area, and associated mean annual water supply volume, by NFS region in the contiguous U.S.

Table F2. National Forest System land area according to two area designations, and associated mean annual water supply volume, by state in the contiguous U.S.

Table F3. National Forest System ownership land area, and associated mean annual water supply volume, by unit of the NFS in the contiguous U.S.

G. Mean Annual 1981-2010 Water Supply and Land Area of Designated Wilderness Areas

Table G1. Wilderness land area and associated mean annual water supply volume, by federal agency and state of the contiguous U.S.

A. Mean Annual 1981-2010 Water Supply Volume

Table A1. Mean annual water supply of the contiguous U.S. by region and federal agency, m^3 x 10^{-9}.*

Region	FS	BLM	NPS	Other fed	S&P	Total
East	7.4	0.0	0.3	1.6	257.0	266.3
South	56.0	0.0	5.2	14.9	593.1	669.2
Midwest	21.2	0.0	0.6	2.6	315.9	340.4
Plains	3.5	0.0	0.2	2.3	134.0	140.1
West	248.3	31.5	32.8	5.3	187.9	505.8
U.S.	336.5	31.5	39.1	26.7	1487.8	1921.8

* 2005 Federal land designations taken from the Federal Lands of the United States database of the National Atlas of the U.S.

Table A2. Mean annual water supply of the contiguous U.S. by WRR and federal agency, m^3 x 10^{-6}.*

WRR	FS	BLM	NPS	Other fed	S&P	Total
1	4,438	0	11	406	94,498	99,353
2	5,013	0	752	1,046	130,524	137,335
3	17,215	0	1,803	7,060	274,314	300,392
4	8,481	0	171	611	91,627	100,890
5	15,751	0	645	2,304	185,035	203,735
6	13,514	0	2,042	2,246	50,626	68,429
7	3,388	0	203	1,129	123,467	128,186
8	5,577	0	65	2,815	126,268	134,725
9	1,356	0	57	122	10,618	12,152
10	20,512	1,876	6,188	985	80,563	110,125
11	10,879	50	401	2,152	95,552	109,035
12	2,035	1	147	821	49,783	52,786
13	2,845	424	150	119	3,084	6,623
14	13,346	2,869	356	68	3,635	20,276
15	1,983	860	113	177	2,193	5,326
16	6,414	5,828	54	579	3,074	15,950
17	151,832	15,297	20,347	3,074	120,848	311,398
18	51,938	4,309	5,642	1,032	42,137	105,058
U.S.	336,518	31,515	39,146	26,748	1,487,848	1,921,775

* 2005 Federal land designations taken from the Federal Lands of the United States database of the National Atlas of the U.S.

Table A3. Mean annual water supply of the contiguous U.S. by state and federal agency, m^3 x 10^{-6}.*

State	FS	BLM	NPS	Other fed	S&P	Total
AL	3,270	0	41	1,026	74,961	79,298
AZ	1,462	425	93	123	2,075	4,178
AR	7,407	0	193	1,391	56,953	65,944
CA	51,719	4,073	5,376	898	41,459	103,526
CO	14,265	1,537	723	54	4,325	20,904
CT	0	0	0	10	8,418	8,428
DE	0	0	0	38	2,000	2,039
DC	0	0	7	3	85	96
FL	1,989	0	1,596	1,529	39,064	44,177
GA	5,523	0	63	2,335	57,217	65,138
ID	38,650	3,538	231	344	11,223	53,986
IL	1,773	0	0	338	45,625	47,735
IN	1,189	0	14	435	34,628	36,266
IA	0	0	3	201	34,639	34,842
KS	12	0	10	256	22,279	22,557
KY	4,361	0	203	998	47,111	52,673
LA	1,870	0	48	1,694	59,131	62,743
ME	232	0	7	166	52,833	53,238
MD	0	0	84	164	9,676	9,924
MA	0	0	2	124	12,347	12,473
MI	5,912	0	106	298	36,836	43,151
MN	3,250	0	145	326	27,880	31,602
MS	5,325	0	8	889	61,652	67,873
MO	4,892	0	203	582	56,952	62,629
MT	28,774	1,159	3,753	307	13,450	47,442
NE	54	0	12	49	12,771	12,886
NV	2,217	5,963	42	674	1,408	10,304
NH	3,043	0	0	42	13,063	16,147
NJ	0	0	108	223	9,912	10,244
NM	1,540	553	19	116	2,341	4,570
NY	36	0	12	420	70,536	71,004
NC	10,122	0	1,131	1,379	46,038	58,671
ND	128	2	3	98	5,579	5,810
OH	1,515	0	51	144	38,630	40,342
OK	816	0	5	915	28,424	30,159
OR	48,163	11,377	604	343	51,577	112,063
PA	1,873	0	100	256	62,755	64,984
RI	0	0	0	1	1,534	1,535
SC	2,519	0	49	644	27,077	30,289
SD	387	22	27	81	5,635	6,151
TN	3,039	0	1,159	2,144	59,472	65,814
TX	2,136	1	179	924	59,276	62,516
UT	4,901	1,413	137	90	2,176	8,716
VT	2,255	0	2	108	13,810	16,174

VA	5,571	0	510	744	36,607	43,432
WA	44,200	125	15,539	2,169	54,127	116,161
WV	5,021	0	176	138	27,819	33,154
WI	2,709	0	112	318	40,695	43,834
WY	12,398	1,326	6,263	198	3,767	23,951
U.S.	336,518	31,515	39,146	26,748	1,487,848	1,921,775

* 2005 Federal land designations taken from the Federal Lands of the United States database of the National Atlas of the U.S.

Table A4. Mean annual water supply of the contiguous U.S. by region and NLCD cover type, $m^3 \times 10^{-9}$.

Region	Forest	Range	Agriculture	Developed	Riparian	Other	Total
East	160	10	39	28	20	9	266
South	307	56	148	58	81	19	669
Midwest	97	10	169	32	25	8	340
Plains	26	44	49	11	7	3	140
West	295	151	19	16	6	20	506
U.S.	884	271	424	146	138	59	1922

Table A5. Mean annual water supply of the contiguous U.S. by WRR and NLCD cover type, $m^3 \times 10^{-6}$.

WRR	Forest	Range	Agriculture	Developed	Riparian	Other	Total
1	66,091	5,652	4,551	8,548	10091	4,421	99354
2	77,476	3,162	27,350	18,042	7770	3,536	137335
3	128,821	35,450	49,801	30,255	48947	7,119	300392
4	37,198	4,770	30,364	10,227	15164	3,168	100890
5	105,850	5,908	68,731	18,746	1371	3,129	203735
6	41,273	4,026	14,666	5,833	879	1,752	68429
7	29,497	4,031	71,552	11,783	7855	3,469	128186
8	33,559	9,209	49,167	9,153	26807	6,828	134725
9	1,874	613	5,424	455	2994	793	12153
10	27,405	32,060	41,063	4,701	1959	2,937	110125
11	45,094	19,076	32,229	6,740	3330	2,565	109035
12	11,564	15,879	12,533	6,064	5166	1,580	52786
13	2,328	3,866	58	71	118	181	6623
14	10,834	6,979	283	133	362	1,684	20276
15	1,920	3,172	41	104	13	76	5326
16	4,855	9,515	375	374	123	708	15950
17	198,404	74,002	12,925	10,572	4271	11,224	311398
18	59,772	33,429	3,314	4,090	572	3,881	105058
U.S.	883,814	270,800	424,427	145,890	137,794	59,051	1,921,776

Table A6. Mean annual water supply of the contiguous U.S. by state and NLCD cover type, $m^3 \times 10^{-6}$.

State	Forest	Range	Agriculture	Developed	Riparian	Other	Total
AL	41,606	10,210	13,580	5,800	6250	1,853	79298
AZ	1,335	2,622	36	90	12	84	4178
AR	29,703	2,797	22,276	3,861	5676	1,631	65944
CA	58,537	33,275	3,180	4,101	508	3,924	103526
CO	11,370	6,234	735	207	506	1,854	20904
CT	4,737	144	636	1,894	762	255	8428
DE	228	44	817	405	451	93	2039
DC	10	0	0	82	1	2	96
FL	9,114	5,538	6,308	6,881	14648	1,688	44177
GA	31,015	6,271	10,899	7,244	8415	1,294	65138
ID	32,131	18,588	1,720	372	388	787	53986
IL	7,730	348	32,135	5,839	819	865	47735
IN	8,972	694	21,740	3,878	498	485	36266
IA	2,935	1,765	26,466	2,614	677	386	34842
KS	1,665	7,129	11,665	1,513	258	327	22557
KY	27,438	2,324	17,338	3,906	545	1,122	52673
LA	13,301	5,967	15,204	4,641	18587	5,044	62743
ME	35,586	4,650	1,902	1,767	6399	2,934	53239
MD	3,563	182	3,059	1,919	955	246	9924
MA	6,547	180	774	2,995	1486	492	12473
MI	15,333	2,308	11,289	4,740	8275	1,206	43151
MN	7,840	1,586	11,535	1,935	6800	1,906	31602
MS	26,197	8,834	16,928	4,373	9908	1,634	67873
MO	24,140	1,190	30,785	4,294	1247	972	62629
MT	26,585	16,430	2,109	351	419	1,550	47442
NE	368	4,844	6,551	678	295	150	12886
NV	1,597	8,202	93	75	66	272	10304
NH	12,438	487	577	1,119	967	560	16147
NJ	2,996	242	1,463	3,145	2021	376	10244
NM	1,690	2,669	89	47	22	53	4570
NY	41,543	2,742	13,732	5,675	4844	2,468	71004
NC	29,166	4,537	11,119	6,117	6704	1,029	58671
ND	93	1,140	3,791	271	296	218	5810
OH	13,188	829	19,450	5,994	337	545	40342
OK	10,417	7,913	8,767	2,021	234	807	30159
OR	72,364	24,363	6,848	4,488	1264	2,737	112063
PA	39,509	1,345	14,160	7,827	1062	1,080	64984
RI	759	29	61	421	196	67	1535
SC	12,243	3,405	4,591	2,991	6011	1,048	30289
SD	273	2,705	2,615	205	150	202	6151
TN	34,175	3,972	18,210	6,180	1740	1,539	65814
TX	13,342	19,863	15,604	6,644	5432	1,631	62516
UT	4,509	3,008	244	285	60	612	8716
VT	11,893	311	1,909	826	706	529	16175

VA	25,652	1,970	9,060	4,137	1969	645	43432
WA	74,505	22,729	4,073	5,548	2366	6,940	116161
WV	27,135	514	2,706	2,257	54	488	33154
WI	16,446	1,239	15,367	3,152	6037	1,591	43834
WY	9,896	12,433	231	88	472	831	23951
U.S.	883,814	270,800	424,427	145,890	137,794	59,051	1,921,776

Table A7. Mean annual water supply of the contiguous U.S. by region and LandFire/PHYS cover type, $m^3 \times 10^{-9}$.

Region	Forest	Rangeland	Agriculture	Developed	Riparian	Other	Total
East	165	1	32	39	19	9.8	266
South	340	7	142	90	70	20.4	669
Midwest	101	3	159	49	21	8.4	340
Plains	30	27	50	21	9	3.6	140
West	325	97	17	20	17	29.4	506
U.S.	961	135	400	219	136	72	1922

Table A8. Mean annual water supply of the contiguous U.S. by WRR and LandFire/PHYS cover type, $m^3 \times 10^{-6}$.

WRR	Forest	Rangeland	Agriculture	Developed	Riparian	Other	Total
1	70,810	372	3,237	10,938	9604	4,393	99353
2	78,542	647	23,218	24,806	5772	4,350	137335
3	153,737	5,592	45,552	48,836	39124	7,551	300392
4	40,227	1,152	27,770	14,487	13942	3,312	100890
5	105,407	496	66,707	24,353	3103	3,669	203735
6	43,006	248	14,429	7,773	1054	1,918	68429
7	32,053	1,031	64,841	20,582	6042	3,638	128186
8	37,969	564	47,830	14,844	26415	7,103	134725
9	2,319	419	4,684	1,349	2539	841	12152
10	29,317	23,205	40,004	9,275	3016	5,308	110125
11	46,070	10,806	33,051	12,636	3751	2,721	109035
12	15,916	7,080	12,725	9,645	5800	1,619	52786
13	3,054	3,023	57	120	103	266	6623
14	11,495	5,439	191	287	367	2,497	20276
15	2,011	2,708	48	128	143	289	5326
16	5,721	8,013	366	509	201	1,141	15950
17	217,644	41,188	12,087	13,201	12292	14,985	311398
18	65,858	22,853	2,755	5,052	2564	5,976	105058
U.S.	961,156	134,835	399,554	218,821	135,833	71,577	1,921,775

Table A9. Mean annual water supply of the contiguous U.S. by state and LandFire/PHYS cover type, $m^3 \times 10^{-6}$.

State	Forest	Rangeland	Agriculture	Developed	Riparian	Other	Total
AL	45,828	879	13,240	9,790	7402	2,158	79298
AZ	1,427	2,256	41	111	113	231	4178
AR	30,526	421	22,060	6,059	5182	1,697	65944
CA	64,772	22,451	2,638	5,034	2484	6,146	103526
CO	12,594	4,678	596	476	321	2,239	20904
CT	4,729	5	369	2,356	731	238	8428
DE	390	27	735	549	211	127	2039
DC	9	0	0	83	0	4	96
FL	15,942	764	6,014	9,460	10394	1,603	44177
GA	35,818	635	9,560	11,537	6190	1,398	65138
ID	33,467	13,941	1,761	664	1286	2,867	53986
IL	7,422	250	31,783	6,443	831	1,006	47735
IN	8,708	77	21,252	4,992	673	563	36266
IA	3,529	303	21,738	8,033	854	385	34842
KS	1,387	3,973	13,421	2,714	738	324	22557
KY	27,745	138	17,704	5,003	851	1,232	52673
LA	16,480	362	14,511	7,407	18872	5,111	62743
ME	39,680	285	1,479	2,561	6291	2,943	53238
MD	3,657	58	2,559	2,813	478	358	9924
MA	6,645	13	493	3,550	1294	478	12473
MI	16,540	815	10,669	6,201	7619	1,306	43151
MN	9,971	472	9,296	4,508	5361	1,993	31602
MS	30,142	732	16,522	8,748	9865	1,863	67873
MO	23,281	517	30,690	5,885	1287	970	62629
MT	27,833	12,095	1,519	1,195	1223	3,578	47442
NE	338	3,938	6,440	1,487	528	156	12886
NV	2,247	7,213	82	114	120	527	10304
NH	12,808	61	361	1,481	883	553	16147
NJ	3,730	88	992	3,886	999	550	10244
NM	1,979	2,195	107	83	66	140	4570
NY	41,451	406	11,265	8,997	6375	2,511	71004
NC	32,546	2,205	8,803	9,920	4150	1,046	58671
ND	63	970	3,370	869	277	261	5810
OH	12,683	32	18,930	7,255	863	580	40342
OK	10,625	5,145	8,337	4,507	669	876	30159
OR	81,808	11,503	6,542	5,850	3976	2,385	112063
PA	39,365	109	11,743	11,235	1059	1,474	64984
RI	768	1	38	475	186	67	1535
SC	15,872	277	4,431	4,641	4029	1,039	30289
SD	274	2,392	2,485	616	138	246	6151
TN	35,425	223	18,579	8,122	1758	1,707	65814
TX	17,565	10,301	16,001	10,795	6156	1,697	62516
UT	4,487	2,533	233	390	118	956	8716
VT	12,151	9	1,672	1,226	589	528	16174

VA	26,609	555	8,235	5,860	1256	918	43432
WA	81,845	10,397	3,733	6,254	6307	7,626	116161
WV	26,772	124	2,086	3,029	499	644	33154
WI	18,867	243	14,217	5,333	3586	1,588	43834
WY	12,355	7,767	223	225	697	2,684	23951
U.S.	961,156	134,835	399,554	218,821	135,833	71,577	1,921,775

Figure A1. Water yield by state and federal agency

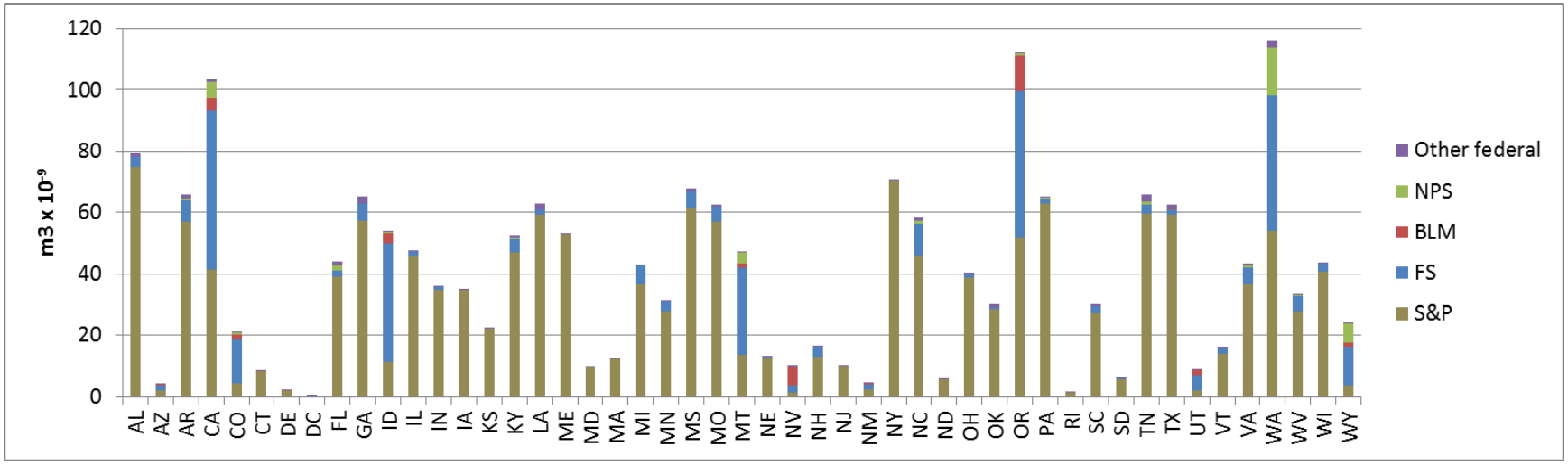
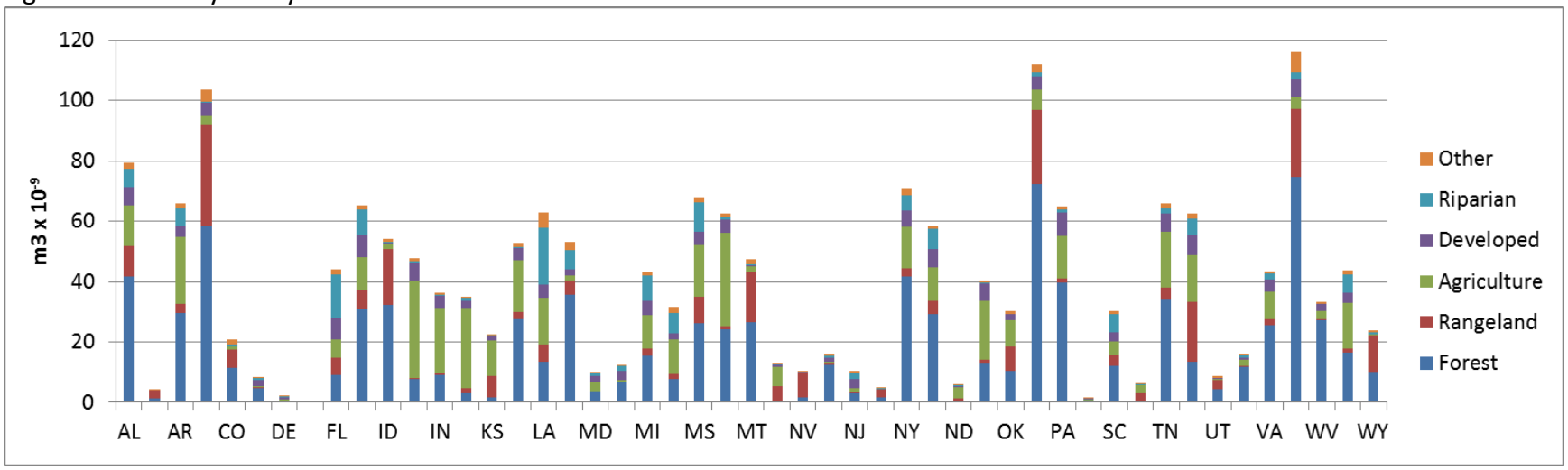


Figure A2. Water yield by state and NLCD cover class



B. Percent of Mean Annual 1981-2010 Water Supply

Table B1. Percent of mean annual water supply of the contiguous U.S. by region and federal agency.*

Region	FS	BLM	NPS	Other fed	S&P
East	2.8	0.0	0.1	0.6	96.5
South	8.4	0.0	0.8	2.2	88.6
Midwest	6.2	0.0	0.2	0.8	92.8
Plains	2.5	0.0	0.2	1.7	95.6
West	49.1	6.2	6.5	1.1	37.2
U.S.	17.5	1.6	2.0	1.4	77.4

* Federal land designations taken from the 2005 Federal Lands of the United States database of the National Atlas of the U.S.

Table B2. Percent of mean annual water supply of the contiguous U.S. by WRR and federal agency.*

WRR	FS	BLM	NPS	Other fed	S&P
1	4.5	0.0	0.0	0.4	95.1
2	3.6	0.0	0.5	0.8	95.0
3	5.7	0.0	0.6	2.4	91.3
4	8.4	0.0	0.2	0.6	90.8
5	7.7	0.0	0.3	1.1	90.8
6	19.7	0.0	3.0	3.3	74.0
7	2.6	0.0	0.2	0.9	96.3
8	4.1	0.0	0.0	2.1	93.7
9	11.2	0.0	0.5	1.0	87.4
10	18.6	1.7	5.6	0.9	73.2
11	10.0	0.0	0.4	2.0	87.6
12	3.9	0.0	0.3	1.6	94.3
13	43.0	6.4	2.3	1.8	46.6
14	65.8	14.2	1.8	0.3	17.9
15	37.2	16.1	2.1	3.3	41.2
16	40.2	36.5	0.3	3.6	19.3
17	48.8	4.9	6.5	1.0	38.8
18	49.4	4.1	5.4	1.0	40.1
U.S.	17.5	1.6	2.0	1.4	77.4

* Federal land designations taken from the 2005 Federal Lands of the United States database of the National Atlas of the U.S.

Table B3. Percent of mean annual water supply of the contiguous U.S. by state and federal agency.*

State	FS	BLM	NPS	Other fed	S&P
AL	4.1	0.0	0.1	1.3	94.5
AZ	35.0	10.2	2.2	2.9	49.7
AR	11.2	0.0	0.3	2.1	86.4
CA	50.0	3.9	5.2	0.9	40.0
CO	68.2	7.4	3.5	0.3	20.7
CT	0.0	0.0	0.0	0.1	99.9
DE	0.0	0.0	0.0	1.9	98.1
DC	0.0	0.0	7.6	3.6	88.8
FL	4.5	0.0	3.6	3.5	88.4
GA	8.5	0.0	0.1	3.6	87.8
ID	71.6	6.6	0.4	0.6	20.8
IL	3.7	0.0	0.0	0.7	95.6
IN	3.3	0.0	0.0	1.2	95.5
IA	0.0	0.0	0.0	0.6	99.4
KS	0.1	0.0	0.0	1.1	98.8
KY	8.3	0.0	0.4	1.9	89.4
LA	3.0	0.0	0.1	2.7	94.2
ME	0.4	0.0	0.0	0.3	99.2
MD	0.0	0.0	0.9	1.6	97.5
MA	0.0	0.0	0.0	1.0	99.0
MI	13.7	0.0	0.2	0.7	85.4
MN	10.3	0.0	0.5	1.0	88.2
MS	7.8	0.0	0.0	1.3	90.8
MO	7.8	0.0	0.3	0.9	90.9
MT	60.6	2.4	7.9	0.6	28.3
NE	0.4	0.0	0.1	0.4	99.1
NV	21.5	57.9	0.4	6.5	13.7
NH	18.8	0.0	0.0	0.3	80.9
NJ	0.0	0.0	1.1	2.2	96.8
NM	33.7	12.1	0.4	2.5	51.2
NY	0.1	0.0	0.0	0.6	99.3
NC	17.3	0.0	1.9	2.4	78.5
ND	2.2	0.0	0.1	1.7	96.0
OH	3.8	0.0	0.1	0.4	95.8
OK	2.7	0.0	0.0	3.0	94.2
OR	43.0	10.2	0.5	0.3	46.0
PA	2.9	0.0	0.2	0.4	96.6
RI	0.0	0.0	0.0	0.1	99.9
SC	8.3	0.0	0.2	2.1	89.4
SD	6.3	0.4	0.4	1.3	91.6
TN	4.6	0.0	1.8	3.3	90.4
TX	3.4	0.0	0.3	1.5	94.8
UT	56.2	16.2	1.6	1.0	25.0
VT	13.9	0.0	0.0	0.7	85.4

VA	12.8	0.0	1.2	1.7	84.3
WA	38.1	0.1	13.4	1.9	46.6
WV	15.1	0.0	0.5	0.4	83.9
WI	6.2	0.0	0.3	0.7	92.8
WY	51.8	5.5	26.1	0.8	15.7
U.S.	17.5	1.6	2.0	1.4	77.4

* Federal land designations taken from the 2005 Federal Lands of the United States database of the National Atlas of the U.S.

Table B4. Percent of mean annual water supply of the contiguous U.S. by region and NLCD cover type.

Region	Forest	Range	Agriculture	Developed	Riparian	Other
East	60.0	3.9	14.7	10.5	7.5	3.4
South	45.8	8.4	22.1	8.7	12.0	2.8
Midwest	28.4	2.9	49.6	9.5	7.3	2.3
Plains	18.7	31.1	35.0	8.1	4.8	2.4
West	58.2	29.8	3.8	3.1	1.2	3.9
U.S.	46.0	14.1	22.1	7.6	7.2	3.1

Table B5. Percent of mean annual water supply of the contiguous U.S. by WRR and NLCD cover type.

WRR	Forest	Range	Agriculture	Developed	Riparian	Other
1	66.5	5.7	4.6	8.6	10.2	4.4
2	56.4	2.3	19.9	13.1	5.7	2.6
3	42.9	11.8	16.6	10.1	16.3	2.4
4	36.9	4.7	30.1	10.1	15.0	3.1
5	52.0	2.9	33.7	9.2	0.7	1.5
6	60.3	5.9	21.4	8.5	1.3	2.6
7	23.0	3.1	55.8	9.2	6.1	2.7
8	24.9	6.8	36.5	6.8	19.9	5.1
9	15.4	5.0	44.6	3.7	24.6	6.5
10	24.9	29.1	37.3	4.3	1.8	2.7
11	41.4	17.5	29.6	6.2	3.1	2.4
12	21.9	30.1	23.7	11.5	9.8	3.0
13	35.2	58.4	0.9	1.1	1.8	2.7
14	53.4	34.4	1.4	0.7	1.8	8.3
15	36.1	59.5	0.8	2.0	0.3	1.4
16	30.4	59.7	2.4	2.3	0.8	4.4
17	63.7	23.8	4.2	3.4	1.4	3.6
18	56.9	31.8	3.2	3.9	0.5	3.7
U.S.	46.0	14.1	22.1	7.6	7.2	3.1

Table B6. Percent of mean annual water supply of the contiguous U.S. by state and NLCD cover type.

State	Forest	Range	Agriculture	Developed	Riparian	Other
AL	52.5	12.9	17.1	7.3	7.9	2.3
AZ	31.9	62.7	0.9	2.1	0.3	2.0
AR	45.0	4.2	33.8	5.9	8.6	2.5
CA	56.5	32.1	3.1	4.0	0.5	3.8
CO	54.4	29.8	3.5	1.0	2.4	8.9
CT	56.2	1.7	7.5	22.5	9.0	3.0
DE	11.2	2.2	40.1	19.9	22.1	4.6
DC	10.4	0.2	0.1	85.7	1.1	2.6
FL	20.6	12.5	14.3	15.6	33.2	3.8
GA	47.6	9.6	16.7	11.1	12.9	2.0
ID	59.5	34.4	3.2	0.7	0.7	1.5
IL	16.2	0.7	67.3	12.2	1.7	1.8
IN	24.7	1.9	59.9	10.7	1.4	1.3
IA	8.4	5.1	76.0	7.5	1.9	1.1
KS	7.4	31.6	51.7	6.7	1.1	1.5
KY	52.1	4.4	32.9	7.4	1.0	2.1
LA	21.2	9.5	24.2	7.4	29.6	8.0
ME	66.8	8.7	3.6	3.3	12.0	5.5
MD	35.9	1.8	30.8	19.3	9.6	2.5
MA	52.5	1.4	6.2	24.0	11.9	3.9
MI	35.5	5.3	26.2	11.0	19.2	2.8
MN	24.8	5.0	36.5	6.1	21.5	6.0
MS	38.6	13.0	24.9	6.4	14.6	2.4
MO	38.5	1.9	49.2	6.9	2.0	1.6
MT	56.0	34.6	4.4	0.7	0.9	3.3
NE	2.9	37.6	50.8	5.3	2.3	1.2
NV	15.5	79.6	0.9	0.7	0.6	2.6
NH	77.0	3.0	3.6	6.9	6.0	3.5
NJ	29.2	2.4	14.3	30.7	19.7	3.7
NM	37.0	58.4	1.9	1.0	0.5	1.2
NY	58.5	3.9	19.3	8.0	6.8	3.5
NC	49.7	7.7	19.0	10.4	11.4	1.8
ND	1.6	19.6	65.2	4.7	5.1	3.8
OH	32.7	2.1	48.2	14.9	0.8	1.4
OK	34.5	26.2	29.1	6.7	0.8	2.7
OR	64.6	21.7	6.1	4.0	1.1	2.4
PA	60.8	2.1	21.8	12.0	1.6	1.7
RI	49.5	1.9	4.0	27.4	12.8	4.4
SC	40.4	11.2	15.2	9.9	19.8	3.5
SD	4.4	44.0	42.5	3.3	2.4	3.3
TN	51.9	6.0	27.7	9.4	2.6	2.3
TX	21.3	31.8	25.0	10.6	8.7	2.6
UT	51.7	34.5	2.8	3.3	0.7	7.0
VT	73.5	1.9	11.8	5.1	4.4	3.3

VA	59.1	4.5	20.9	9.5	4.5	1.5
WA	64.1	19.6	3.5	4.8	2.0	6.0
WV	81.8	1.6	8.2	6.8	0.2	1.5
WI	37.5	2.8	35.1	7.2	13.8	3.6
WY	41.3	51.9	1.0	0.4	2.0	3.5
U.S.	46.0	14.1	22.1	7.6	7.2	3.1

Table B7. Percent of mean annual water supply of the contiguous U.S. by region and LandFire/PHYS cover type.

Region	Forest	Rangeland	Agriculture	Developed	Riparian	Other
East	62.1	0.4	11.9	14.7	7.2	3.7
South	50.8	1.1	21.2	13.4	10.5	3.1
Midwest	29.7	0.8	46.6	14.3	6.2	2.5
Plains	21.6	19.1	35.7	15.0	6.1	2.5
West	64.2	19.2	3.5	4.0	3.3	5.8
U.S.	50.0	7.0	20.8	11.4	7.1	3.7

Table B8. Percent of mean annual water supply of the contiguous U.S. by WRR and LandFire/PHYS cover type.

WRR	Forest	Rangeland	Agriculture	Developed	Riparian	Other
1	71.3	0.4	3.3	11.0	9.7	4.4
2	57.2	0.5	16.9	18.1	4.2	3.2
3	51.2	1.9	15.2	16.3	13.0	2.5
4	39.9	1.1	27.5	14.4	13.8	3.3
5	51.7	0.2	32.7	12.0	1.5	1.8
6	62.8	0.4	21.1	11.4	1.5	2.8
7	25.0	0.8	50.6	16.1	4.7	2.8
8	28.2	0.4	35.5	11.0	19.6	5.3
9	19.1	3.5	38.5	11.1	20.9	6.9
10	26.6	21.1	36.3	8.4	2.7	4.8
11	42.3	9.9	30.3	11.6	3.4	2.5
12	30.2	13.4	24.1	18.3	11.0	3.1
13	46.1	45.6	0.9	1.8	1.6	4.0
14	56.7	26.8	0.9	1.4	1.8	12.3
15	37.7	50.8	0.9	2.4	2.7	5.4
16	35.9	50.2	2.3	3.2	1.3	7.2
17	69.9	13.2	3.9	4.2	3.9	4.8
18	62.7	21.8	2.6	4.8	2.4	5.7
U.S.	50.0	7.0	20.8	11.4	7.1	3.7

Table B9. Percent of mean annual water supply of the contiguous U.S. by state and LandFire/PHYS cover type.

State	Forest	Rangeland	Agriculture	Developed	Riparian	Other
AL	57.8	1.1	16.7	12.3	9.3	2.7
AZ	34.1	54.0	1.0	2.6	2.7	5.5
AR	46.3	0.6	33.5	9.2	7.9	2.6
CA	62.6	21.7	2.5	4.9	2.4	5.9
CO	60.2	22.4	2.8	2.3	1.5	10.7
CT	56.1	0.1	4.4	28.0	8.7	2.8
DE	19.1	1.3	36.0	26.9	10.3	6.2
DC	9.4	0.1	0.0	86.2	0.5	3.8
FL	36.1	1.7	13.6	21.4	23.5	3.6
GA	55.0	1.0	14.7	17.7	9.5	2.1
ID	62.0	25.8	3.3	1.2	2.4	5.3
IL	15.5	0.5	66.6	13.5	1.7	2.1
IN	24.0	0.2	58.6	13.8	1.9	1.6
IA	10.1	0.9	62.4	23.1	2.5	1.1
KS	6.1	17.6	59.5	12.0	3.3	1.4
KY	52.7	0.3	33.6	9.5	1.6	2.3
LA	26.3	0.6	23.1	11.8	30.1	8.1
ME	74.5	0.5	2.8	4.8	11.8	5.5
MD	36.9	0.6	25.8	28.3	4.8	3.6
MA	53.3	0.1	4.0	28.5	10.4	3.8
MI	38.3	1.9	24.7	14.4	17.7	3.0
MN	31.6	1.5	29.4	14.3	17.0	6.3
MS	44.4	1.1	24.3	12.9	14.5	2.7
MO	37.2	0.8	49.0	9.4	2.1	1.5
MT	58.7	25.5	3.2	2.5	2.6	7.5
NE	2.6	30.6	50.0	11.5	4.1	1.2
NV	21.8	70.0	0.8	1.1	1.2	5.1
NH	79.3	0.4	2.2	9.2	5.5	3.4
NJ	36.4	0.9	9.7	37.9	9.8	5.4
NM	43.3	48.0	2.3	1.8	1.4	3.1
NY	58.4	0.6	15.9	12.7	9.0	3.5
NC	55.5	3.8	15.0	16.9	7.1	1.8
ND	1.1	16.7	58.0	15.0	4.8	4.5
OH	31.4	0.1	46.9	18.0	2.1	1.4
OK	35.2	17.1	27.6	14.9	2.2	2.9
OR	73.0	10.3	5.8	5.2	3.5	2.1
PA	60.6	0.2	18.1	17.3	1.6	2.3
RI	50.1	0.1	2.5	31.0	12.1	4.3
SC	52.4	0.9	14.6	15.3	13.3	3.4
SD	4.5	38.9	40.4	10.0	2.3	4.0
TN	53.8	0.3	28.2	12.3	2.7	2.6
TX	28.1	16.5	25.6	17.3	9.8	2.7
UT	51.5	29.1	2.7	4.5	1.3	11.0
VT	75.1	0.1	10.3	7.6	3.6	3.3

VA	61.3	1.3	19.0	13.5	2.9	2.1
WA	70.5	9.0	3.2	5.4	5.4	6.6
WV	80.7	0.4	6.3	9.1	1.5	1.9
WI	43.0	0.6	32.4	12.2	8.2	3.6
WY	51.6	32.4	0.9	0.9	2.9	11.2
U.S.	50.0	7.0	20.8	11.4	7.1	3.7

C. Land Area

Table C1. Land area of the contiguous U.S. by region and federal agency, $km^2 \times 10^{-3}$.*

Region	FS	BLM	NPS	Other fed	S&P	Total
East	9	0	1	3	434	447
South	96	0	12	31	1240	1378
Midwest	66	0	2	9	1095	1172
Plains	38	1	6	19	1591	1655
West	637	704	82	113	1513	3048
U.S.	845	705	102	175	5874	7700

* Federal land designations taken from the 2005 Federal Lands of the United States database of the National Atlas of the U.S.

Table C2. Land area of the contiguous U.S. by WRR and federal agency, km^2.*

WRR	FS	BLM	NPS	Other fed	S&P	Total
1	4,904	0	14	636	142,889	148,443
2	10,981	0	1,573	2,203	249,254	264,012
3	29,948	0	6,714	15,939	625,982	678,583
4	28,059	0	467	1,650	260,115	290,291
5	28,129	0	1,141	4,491	388,014	421,775
6	17,215	0	2,161	3,742	82,754	105,872
7	10,849	0	754	4,032	475,813	491,447
8	10,815	0	115	5,417	241,302	257,649
9	9,763	1	318	1,809	138,344	150,234
10	105,170	69,721	11,475	17,409	1,118,301	1,322,076
11	36,702	2,368	1,080	9,821	592,170	642,141
12	7,097	57	469	4,752	446,879	459,254
13	35,076	46,886	5,755	15,330	237,195	340,243
14	58,462	113,303	9,591	2,590	109,966	293,911
15	61,526	90,196	13,048	22,427	173,403	360,599
16	48,871	206,706	1,402	26,361	78,313	361,653
17	239,981	117,018	15,415	14,003	316,565	702,981
18	101,728	58,356	30,391	22,002	196,419	408,896
U.S.	845,276	704,612	101,882	174,613	5,873,677	7,700,060

* Federal land designations taken from the 2005 Federal Lands of the United States database of the National Atlas of the U.S.

Table C3. Land area of the contiguous U.S. by state and federal agency, km^2.*

State	FS	BLM	NPS	Other fed	S&P	Total
AL	5,160	0	63	1,733	126,247	133,203
AZ	47,168	50,278	10,254	18,683	166,822	293,205
AR	13,884	0	427	3,009	120,371	137,691
CA	97,873	61,027	31,250	19,612	192,497	402,260
CO	69,220	33,037	2,990	2,728	161,761	269,736
CT	0	0	0	14	12,442	12,456
DE	0	0	0	64	4,725	4,789
DC	0	0	12	6	139	156
FL	5,170	0	6,355	3,733	122,934	138,193
GA	7,175	0	101	5,258	138,818	151,353
ID	86,756	47,611	1,998	4,268	75,791	216,424
IL	3,574	0	0	925	141,202	145,701
IN	2,546	0	36	994	90,138	93,714
IA	0	0	7	641	145,199	145,846
KS	520	0	47	1,768	210,788	213,124
KY	8,209	0	368	1,889	94,058	104,525
LA	3,775	0	79	3,205	109,393	116,452
ME	314	0	8	238	78,709	79,269
MD	0	0	202	369	22,266	22,837
MA	0	0	3	201	18,852	19,057
MI	18,838	0	292	1,026	122,114	142,270
MN	17,959	0	714	2,043	194,229	214,945
MS	9,492	0	15	1,607	112,200	123,314
MO	11,978	0	463	1,672	166,462	180,575
MT	76,677	30,984	5,029	6,034	260,715	379,439
NE	2,252	0	194	1,089	196,671	200,206
NV	25,180	194,933	2,712	25,149	38,310	286,284
NH	3,300	0	0	66	20,347	23,713
NJ	0	0	171	436	18,247	18,854
NM	42,153	57,328	1,618	15,057	198,024	314,180
NY	84	0	23	807	120,708	121,622
NC	11,887	0	1,215	2,959	107,319	123,382
ND	8,964	172	291	3,795	168,931	182,154
OH	3,456	0	140	379	101,831	105,805
OK	3,198	0	40	4,362	173,440	181,040
OR	70,612	62,761	793	3,135	111,373	248,674
PA	2,901	0	168	469	113,474	117,012
RI	0	0	0	1	2,237	2,239
SC	5,443	0	110	1,890	70,421	77,864
SD	13,577	826	1,249	2,506	181,601	199,759
TN	4,929	0	1,334	3,703	99,216	109,181
TX	9,013	48	4,225	5,668	659,330	678,284
UT	37,044	94,722	7,988	8,366	66,220	214,340
VT	2,544	0	3	185	21,953	24,685
VA	12,837	0	1,111	1,566	84,669	100,183

WA	40,074	1,244	7,601	5,634	115,992	170,545
WV	7,579	0	352	229	54,530	62,690
WI	8,021	0	352	1,007	134,157	143,536
WY	43,938	69,641	9,479	4,435	125,803	253,297
U.S.	845,276	704,612	101,882	174,613	5,873,677	7,700,060

* Federal land designations taken from the 2005 Federal Lands of the United States database of the National Atlas of the U.S.

Table C4. Land area of the contiguous U.S. by region and NLCD cover type, $km^2 \times 10^{-3}$.

Region	Forest	Range	Agriculture	Developed	Riparian	Other	Total
East	258	17	75	49	33	15	447
South	600	121	312	119	186	39	1378
Midwest	296	37	607	103	99	31	1172
Plains	134	810	550	85	44	32	1655
West	699	1896	241	77	31	104	3048
U.S.	1987	2882	1785	433	394	220	7700

Table C5. Land area of the contiguous U.S. by WRR and NLCD cover type, km^2.

WRR	Forest	Range	Agriculture	Developed	Riparian	Other	Total
1	97,980	8,612	7,143	12,960	15173	6,575	148,443
2	145,007	6,295	56,620	34,163	15357	6,569	264,012
3	264,771	81,273	122,871	66,203	126910	16,555	678,583
4	99,327	13,522	92,594	29,069	47042	8,738	290,291
5	205,187	11,687	155,905	39,898	2706	6,392	421,775
6	61,313	6,383	24,569	9,288	1432	2,887	105,872
7	98,801	16,737	289,012	42,046	30595	14,255	491,447
8	67,497	17,930	93,310	17,140	49503	12,269	257,649
9	15,009	11,095	83,657	6,190	26738	7,547	150,236
10	119,438	687,864	423,696	42,358	25794	22,929	1,322,078
11	134,520	276,101	180,631	30,942	9837	10,110	642,141
12	65,155	216,493	111,885	36,073	21555	8,093	459,254
13	38,097	284,178	5,512	5,062	2119	5,274	340,242
14	83,450	180,029	7,620	2,564	3094	17,154	293,911
15	62,771	275,101	5,888	7,980	1389	7,470	360,599
16	56,682	263,998	10,149	4,808	2707	23,308	361,653
17	270,762	312,905	72,368	20,204	8159	18,584	702,982
18	101,502	211,596	41,584	25,703	3420	25,091	408,896
U.S.	1,987,270	2,881,799	1,785,013	432,651	393,530	219,800	7,700,063

Table C6. Land area of the contiguous U.S. by state and NLCD cover type, km^2.

State	Forest	Range	Agriculture	Developed	Riparian	Other	Total
AL	70,106	17,209	22,962	9,504	10365	3,058	133,203
AZ	44,175	228,493	5,151	6,582	1198	7,605	293,204
AR	62,931	6,077	45,486	8,128	11675	3,394	137,691
CA	94,712	212,994	40,650	25,674	2981	25,247	402,260
CO	77,136	136,967	38,215	7,531	4154	5,732	269,736
CT	6,972	214	944	2,828	1118	379	12,456
DE	557	112	2,030	852	1053	185	4,789
DC	16	0	0	134	2	4	156
FL	25,101	17,087	24,727	18,333	47354	5,592	138,193
GA	66,679	16,192	27,220	14,909	23646	2,707	151,353
ID	70,798	111,704	23,347	3,671	1995	4,910	216,424
IL	21,931	1,046	100,911	16,820	2431	2,561	145,701
IN	21,172	1,746	58,217	9,963	1404	1,211	93,714
IA	10,079	7,038	113,778	10,804	2672	1,475	145,846
KS	7,854	78,968	111,169	10,999	1856	2,276	213,124
KY	54,518	4,690	34,250	7,742	1098	2,226	104,525
LA	26,934	11,695	27,107	8,337	33420	8,958	116,452
ME	52,764	7,096	2,960	2,575	9552	4,321	79,269
MD	7,860	443	7,376	4,174	2430	553	22,837
MA	9,974	281	1,208	4,544	2290	759	19,057
MI	50,115	7,815	38,689	14,788	26977	3,887	142,270
MN	42,324	9,612	97,584	12,299	41045	12,081	214,945
MS	47,539	15,914	31,472	7,780	17624	2,984	123,314
MO	66,404	3,626	91,529	12,451	3697	2,867	180,575
MT	82,486	219,480	60,644	5,476	5955	5,399	379,441
NE	3,984	107,993	74,063	7,263	4930	1,972	200,206
NV	31,134	237,307	3,094	2,868	1818	10,063	286,284
NH	17,942	715	936	1,796	1490	833	23,713
NJ	5,517	465	2,718	5,624	3862	667	18,854
NM	52,327	247,382	5,665	3,741	1166	3,899	314,180
NY	67,346	4,669	26,668	10,285	8459	4,196	121,622
NC	52,859	11,189	27,325	13,135	16652	2,221	123,382
ND	3,037	56,187	100,611	7,232	8392	6,696	182,155
OH	33,086	2,098	53,282	14,958	951	1,430	105,805
OK	38,585	73,185	53,393	10,967	1033	3,876	181,040
OR	90,256	123,072	19,976	6,519	2949	5,902	248,674
PA	70,203	2,343	26,631	14,107	1814	1,914	117,012
RI	1,083	43	89	640	284	99	2,239
SC	29,331	9,370	12,643	7,286	16783	2,450	77,864
SD	6,869	103,973	72,680	5,704	4265	6,267	199,759
TN	54,861	6,425	31,679	10,387	3184	2,645	109,181
TX	73,716	389,823	138,446	42,507	23088	10,703	678,283
UT	54,627	122,851	7,377	3,603	1415	24,467	214,340
VT	17,434	497	3,257	1,335	1139	1,024	24,685
VA	58,881	4,619	21,326	9,362	4535	1,459	100,183

WA	69,432	52,864	29,332	9,431	2864	6,622	170,545
WV	50,724	1,025	5,550	4,394	86	911	62,690
WI	51,240	4,042	53,044	10,419	19625	5,166	143,536
WY	31,656	203,158	7,599	2,186	4752	3,945	253,297
U.S.	1,987,270	2,881,799	1,785,013	432,651	393530	219,800	7,700,063

Table C7. Land area of the contiguous U.S. by region and LandFire/PHYS cover type, $km^2 \times 10^{-3}$.

Region	Forest	Rangeland	Agriculture	Developed	Riparian	Other	Total
East	267	2	61	69	31	16	447
South	683	16	297	187	153	41	1378
Midwest	315	12	562	168	84	32	1172
Plains	189	633	546	187	62	38	1655
West	811	1611	220	139	67	201	3048
U.S.	2265	2274	1686	750	397	328	7700

Table C8. Land area of the contiguous U.S. by WRR and LandFire/PHYS cover type, km^3.

WRR	Forest	Rangeland	Agriculture	Developed	Riparian	Other	Total
1	105,238	537	5,132	16,595	14409	6,532	148,443
2	147,516	1,363	48,563	47,602	10723	8,244	264,012
3	331,894	12,676	112,557	109,886	94428	17,143	678,583
4	109,763	3,559	85,740	41,108	40911	9,210	290,291
5	203,601	972	151,707	51,456	6583	7,456	421,775
6	64,002	387	24,194	12,391	1742	3,157	105,872
7	107,951	5,529	259,902	79,089	24069	14,907	491,447
8	76,238	1,138	90,788	28,136	48541	12,808	257,649
9	18,112	8,816	71,975	20,616	22329	8,387	150,234
10	126,804	605,890	399,709	114,229	40475	34,970	1,322,076
11	142,336	224,223	185,400	63,824	15061	11,296	642,141
12	114,398	129,736	114,291	66,696	25560	8,574	459,254
13	58,741	252,759	5,684	8,790	5183	9,087	340,243
14	91,052	152,748	6,214	5,815	5524	32,558	293,911
15	74,959	229,974	6,648	10,649	9760	28,610	360,599
16	68,143	241,099	10,002	8,007	2840	31,562	361,653
17	303,389	251,083	70,494	30,715	19147	28,154	702,981
18	120,438	151,585	36,896	34,379	9800	55,798	408,896
U.S.	2,264,576	2,274,075	1,685,893	749,980	397,084	328,452	7,700,060

Table C9. Land area of the contiguous U.S. by state and LandFire/PHYS cover type, km^2.

State	Forest	Rangeland	Agriculture	Developed	Riparian	Other	Total
AL	77,212	1,475	22,399	16,319	12217	3,580	133,203
AZ	52,746	195,771	5,851	8,968	7309	22,560	293,205
AR	64,807	919	45,060	12,762	10614	3,529	137,691
CA	113,519	149,205	36,080	34,190	9797	59,468	402,260
CO	85,607	120,601	33,456	18,297	3332	8,444	269,736
CT	6,958	7	549	3,515	1074	354	12,456
DE	985	53	1,825	1,198	470	259	4,789
DC	15	0	0	134	1	6	156
FL	48,567	2,642	23,550	26,717	31431	5,287	138,193
GA	80,017	1,680	24,274	25,608	16876	2,898	151,353
ID	76,580	94,488	24,061	6,222	5202	9,871	216,424
IL	21,007	758	99,821	18,711	2467	2,935	145,701
IN	20,550	219	56,757	12,967	1808	1,413	93,714
IA	12,353	1,462	95,616	31,701	3264	1,450	145,846
KS	8,871	55,891	123,418	18,059	4581	2,304	213,124
KY	55,175	275	34,965	9,937	1717	2,456	104,525
LA	33,353	733	25,805	13,626	33839	9,097	116,452
ME	59,102	418	2,331	3,736	9347	4,335	79,269
MD	8,193	144	6,228	6,264	1187	821	22,837
MA	10,117	21	773	5,404	2003	739	19,057
MI	53,966	2,793	36,723	19,656	24933	4,199	142,270
MN	52,319	3,977	80,532	31,742	33670	12,705	214,945
MS	54,680	1,255	30,713	15,750	17509	3,407	123,314
MO	63,819	1,527	91,382	17,170	3841	2,836	180,575
MT	85,836	197,422	47,674	25,697	12397	10,413	379,439
NE	4,520	94,158	72,262	17,879	9181	2,206	200,206
NV	42,298	212,890	2,689	3,967	3157	21,284	286,284
NH	18,484	78	591	2,378	1360	822	23,713
NJ	6,925	171	1,850	6,994	1909	1,004	18,854
NM	72,238	214,561	6,946	6,356	4063	10,017	314,180
NY	67,373	698	22,041	16,492	10756	4,262	121,622
NC	61,804	4,556	22,217	21,809	10764	2,231	123,382
ND	1,365	48,330	87,870	26,541	9561	8,487	182,154
OH	31,834	76	51,823	18,303	2254	1,516	105,805
OK	39,108	56,127	50,532	26,519	4451	4,303	181,040
OR	108,926	96,394	19,217	10,513	6448	7,176	248,674
PA	69,811	193	22,197	20,338	1876	2,597	117,012
RI	1,097	2	55	719	268	98	2,239
SC	39,679	739	12,084	11,932	11037	2,392	77,864
SD	7,008	92,842	70,037	17,643	4575	7,654	199,759
TN	56,743	355	32,258	13,682	3213	2,931	109,181
TX	127,948	285,728	141,859	80,146	29865	12,737	678,284
UT	59,306	107,454	7,262	6,256	2626	31,436	214,340
VT	17,819	15	2,876	1,980	975	1,021	24,685
VA	61,103	1,295	19,427	13,414	2820	2,124	100,183

WA	75,842	39,577	28,817	12,179	5967	8,162	170,545
WV	50,131	231	4,340	5,904	899	1,185	62,690
WI	59,069	817	49,180	17,826	11484	5,160	143,536
WY	37,794	183,050	7,618	5,860	6691	12,284	253,297
U.S.	2,264,576	2,274,075	1,685,893	749,980	397,084	328,452	7,700,060

D. Percent of Land Area

Table D1. Percent of land area of the contiguous U.S. by region and federal agency.*

Region	FS	BLM	NPS	Other fed	S&P
East	2.0	0.0	0.1	0.6	97.2
South	6.9	0.0	0.8	2.2	90.0
Midwest	5.7	0.0	0.2	0.7	93.4
Plains	2.3	0.1	0.4	1.2	96.1
West	20.9	23.1	2.7	3.7	49.6
U.S.	11.0	9.2	1.3	2.3	76.3

* Federal land designations taken from the 2005 Federal Lands of the United States database of the National Atlas of the U.S.

Table D2. Percent of land area of the contiguous U.S. by WRR and federal agency.*

WRR	FS	BLM	NPS	Other fed	S&P
1	3.3	0.0	0.0	0.4	96.3
2	4.2	0.0	0.6	0.8	94.4
3	4.4	0.0	1.0	2.3	92.2
4	9.7	0.0	0.2	0.6	89.6
5	6.7	0.0	0.3	1.1	92.0
6	16.3	0.0	2.0	3.5	78.2
7	2.2	0.0	0.2	0.8	96.8
8	4.2	0.0	0.0	2.1	93.7
9	6.5	0.0	0.2	1.2	92.1
10	8.0	5.3	0.9	1.3	84.6
11	5.7	0.4	0.2	1.5	92.2
12	1.5	0.0	0.1	1.0	97.3
13	10.3	13.8	1.7	4.5	69.7
14	19.9	38.6	3.3	0.9	37.4
15	17.1	25.0	3.6	6.2	48.1
16	13.5	57.2	0.4	7.3	21.7
17	34.1	16.6	2.2	2.0	45.0
18	24.9	14.3	7.4	5.4	48.0
U.S.	11.0	9.2	1.3	2.3	76.3

* Federal land designations taken from the 2005 Federal Lands of the United States database of the National Atlas of the U.S.

Table D3. Percent of land area of the contiguous U.S. by state and federal agency.*

State	FS	BLM	NPS	Other fed	S&P
AL	3.9	0.0	0.0	1.3	94.8
AZ	16.1	17.1	3.5	6.4	56.9
AR	10.1	0.0	0.3	2.2	87.4
CA	24.3	15.2	7.8	4.9	47.9
CO	25.7	12.2	1.1	1.0	60.0
CT	0.0	0.0	0.0	0.1	99.9
DE	0.0	0.0	0.0	1.3	98.7
DC	0.0	0.0	7.4	3.7	88.9
FL	3.7	0.0	4.6	2.7	89.0
GA	4.7	0.0	0.1	3.5	91.7
ID	40.1	22.0	0.9	2.0	35.0
IL	2.5	0.0	0.0	0.6	96.9
IN	2.7	0.0	0.0	1.1	96.2
IA	0.0	0.0	0.0	0.4	99.6
KS	0.2	0.0	0.0	0.8	98.9
KY	7.9	0.0	0.4	1.8	90.0
LA	3.2	0.0	0.1	2.8	93.9
ME	0.4	0.0	0.0	0.3	99.3
MD	0.0	0.0	0.9	1.6	97.5
MA	0.0	0.0	0.0	1.1	98.9
MI	13.2	0.0	0.2	0.7	85.8
MN	8.4	0.0	0.3	1.0	90.4
MS	7.7	0.0	0.0	1.3	91.0
MO	6.6	0.0	0.3	0.9	92.2
MT	20.2	8.2	1.3	1.6	68.7
NE	1.1	0.0	0.1	0.5	98.2
NV	8.8	68.1	0.9	8.8	13.4
NH	13.9	0.0	0.0	0.3	85.8
NJ	0.0	0.0	0.9	2.3	96.8
NM	13.4	18.2	0.5	4.8	63.0
NY	0.1	0.0	0.0	0.7	99.2
NC	9.6	0.0	1.0	2.4	87.0
ND	4.9	0.1	0.2	2.1	92.7
OH	3.3	0.0	0.1	0.4	96.2
OK	1.8	0.0	0.0	2.4	95.8
OR	28.4	25.2	0.3	1.3	44.8
PA	2.5	0.0	0.1	0.4	97.0
RI	0.0	0.0	0.0	0.1	99.9
SC	7.0	0.0	0.1	2.4	90.4
SD	6.8	0.4	0.6	1.3	90.9
TN	4.5	0.0	1.2	3.4	90.9
TX	1.3	0.0	0.6	0.8	97.2
UT	17.3	44.2	3.7	3.9	30.9
VT	10.3	0.0	0.0	0.8	88.9
VA	12.8	0.0	1.1	1.6	84.5

WA	23.5	0.7	4.5	3.3	68.0
WV	12.1	0.0	0.6	0.4	87.0
WI	5.6	0.0	0.2	0.7	93.5
WY	17.3	27.5	3.7	1.8	49.7
U.S.	11.0	9.2	1.3	2.3	76.3

* Federal land designations taken from the 2005 Federal Lands of the United States database of the National Atlas of the U.S.

Table D4. Percent of land area of the contiguous U.S. by region and NLCD cover type.

Region	Forest	Rangeland	Agriculture	Developed	Riparian	Other
East	57.7	3.8	16.7	10.9	7.5	3.3
South	43.6	8.8	22.6	8.7	13.5	2.8
Midwest	25.3	3.2	51.8	8.7	8.4	2.6
Plains	8.1	49.0	33.3	5.1	2.6	1.9
West	22.9	62.2	7.9	2.5	1.0	3.4
U.S.	25.8	37.4	23.2	5.6	5.1	2.9

Table D5. Percent of land area of the contiguous U.S. by WRR and NLCD cover type.

WRR	Forest	Range	Agriculture	Developed	Riparian	Other
1	66.0	5.8	4.8	8.7	10.2	4.4
2	54.9	2.4	21.4	12.9	5.8	2.5
3	39.0	12.0	18.1	9.8	18.7	2.4
4	34.2	4.7	31.9	10.0	16.2	3.0
5	48.6	2.8	37.0	9.5	0.6	1.5
6	57.9	6.0	23.2	8.8	1.4	2.7
7	20.1	3.4	58.8	8.6	6.2	2.9
8	26.2	7.0	36.2	6.7	19.2	4.8
9	10.0	7.4	55.7	4.1	17.8	5.0
10	9.0	52.0	32.0	3.2	2.0	1.7
11	20.9	43.0	28.1	4.8	1.5	1.6
12	14.2	47.1	24.4	7.9	4.7	1.8
13	11.2	83.5	1.6	1.5	0.6	1.6
14	28.4	61.3	2.6	0.9	1.1	5.8
15	17.4	76.3	1.6	2.2	0.4	2.1
16	15.7	73.0	2.8	1.3	0.7	6.4
17	38.5	44.5	10.3	2.9	1.2	2.6
18	24.8	51.7	10.2	6.3	0.8	6.1
U.S.	25.8	37.4	23.2	5.6	5.1	2.9

Table D6. Percent of land area of the contiguous U.S. by state and NLCD cover type.

State	Forest	Range	Agriculture	Developed	Riparian	Other
AL	52.6	12.9	17.2	7.1	7.8	2.3
AZ	15.1	77.9	1.8	2.2	0.4	2.6
AR	45.7	4.4	33.0	5.9	8.5	2.5
CA	23.5	52.9	10.1	6.4	0.7	6.3
CO	28.6	50.8	14.2	2.8	1.5	2.1
CT	56.0	1.7	7.6	22.7	9.0	3.0
DE	11.6	2.3	42.4	17.8	22.0	3.9
DC	10.4	0.2	0.1	85.7	1.1	2.6
FL	18.2	12.4	17.9	13.3	34.3	4.0
GA	44.1	10.7	18.0	9.9	15.6	1.8
ID	32.7	51.6	10.8	1.7	0.9	2.3
IL	15.1	0.7	69.3	11.5	1.7	1.8
IN	22.6	1.9	62.1	10.6	1.5	1.3
IA	6.9	4.8	78.0	7.4	1.8	1.0
KS	3.7	37.1	52.2	5.2	0.9	1.1
KY	52.2	4.5	32.8	7.4	1.1	2.1
LA	23.1	10.0	23.3	7.2	28.7	7.7
ME	66.6	9.0	3.7	3.2	12.1	5.5
MD	34.4	1.9	32.3	18.3	10.6	2.4
MA	52.3	1.5	6.3	23.8	12.0	4.0
MI	35.2	5.5	27.2	10.4	19.0	2.7
MN	19.7	4.5	45.4	5.7	19.1	5.6
MS	38.6	12.9	25.5	6.3	14.3	2.4
MO	36.8	2.0	50.7	6.9	2.0	1.6
MT	21.7	57.8	16.0	1.4	1.6	1.4
NE	2.0	53.9	37.0	3.6	2.5	1.0
NV	10.9	82.9	1.1	1.0	0.6	3.5
NH	75.7	3.0	3.9	7.6	6.3	3.5
NJ	29.3	2.5	14.4	29.8	20.5	3.5
NM	16.7	78.7	1.8	1.2	0.4	1.2
NY	55.4	3.8	21.9	8.5	7.0	3.5
NC	42.8	9.1	22.1	10.6	13.5	1.8
ND	1.7	30.8	55.2	4.0	4.6	3.7
OH	31.3	2.0	50.4	14.1	0.9	1.4
OK	21.3	40.4	29.5	6.1	0.6	2.1
OR	36.3	49.5	8.0	2.6	1.2	2.4
PA	60.0	2.0	22.8	12.1	1.6	1.6
RI	48.4	1.9	4.0	28.6	12.7	4.4
SC	37.7	12.0	16.2	9.4	21.6	3.1
SD	3.4	52.0	36.4	2.9	2.1	3.1
TN	50.2	5.9	29.0	9.5	2.9	2.4
TX	10.9	57.5	20.4	6.3	3.4	1.6
UT	25.5	57.3	3.4	1.7	0.7	11.4
VT	70.6	2.0	13.2	5.4	4.6	4.1
VA	58.8	4.6	21.3	9.3	4.5	1.5

WA	40.7	31.0	17.2	5.5	1.7	3.9
WV	80.9	1.6	8.9	7.0	0.1	1.5
WI	35.7	2.8	37.0	7.3	13.7	3.6
WY	12.5	80.2	3.0	0.9	1.9	1.6
U.S.	25.8	37.4	23.2	5.6	5.1	2.9

Table D7. Percent of land area of the contiguous U.S. by region and LandFire/PHYS cover type.

Region	Forest	Rangeland	Agriculture	Developed	Riparian	Other
East	59.7	0.4	13.7	15.5	7.0	3.7
South	49.6	1.2	21.6	13.6	11.1	3.0
Midwest	26.9	1.0	47.9	14.3	7.1	2.7
Plains	11.4	38.3	33.0	11.3	3.8	2.3
West	26.6	52.9	7.2	4.5	2.2	6.6
U.S.	29.4	29.5	21.9	9.7	5.2	4.3

Table D8. Percent of land area of the contiguous U.S. by WRR and LandFire/PHYS cover type.

WRR	Forest	Rangeland	Agriculture	Developed	Riparian	Other
1	70.9	0.4	3.5	11.2	9.7	4.4
2	55.9	0.5	18.4	18.0	4.1	3.1
3	48.9	1.9	16.6	16.2	13.9	2.5
4	37.8	1.2	29.5	14.2	14.1	3.2
5	48.3	0.2	36.0	12.2	1.6	1.8
6	60.5	0.4	22.9	11.7	1.6	3.0
7	22.0	1.1	52.9	16.1	4.9	3.0
8	29.6	0.4	35.2	10.9	18.8	5.0
9	12.1	5.9	47.9	13.7	14.9	5.6
10	9.6	45.8	30.2	8.6	3.1	2.6
11	22.2	34.9	28.9	9.9	2.3	1.8
12	24.9	28.2	24.9	14.5	5.6	1.9
13	17.3	74.3	1.7	2.6	1.5	2.7
14	31.0	52.0	2.1	2.0	1.9	11.1
15	20.8	63.8	1.8	3.0	2.7	7.9
16	18.8	66.7	2.8	2.2	0.8	8.7
17	43.2	35.7	10.0	4.4	2.7	4.0
18	29.5	37.1	9.0	8.4	2.4	13.6
U.S.	29.4	29.5	21.9	9.7	5.2	4.3

Table D9. Percent of land area of the contiguous U.S. by state and LandFire/PHYS cover type.

State	Forest	Rangeland	Agriculture	Developed	Riparian	Other
AL	58.0	1.1	16.8	12.3	9.2	2.7
AZ	18.0	66.8	2.0	3.1	2.5	7.7
AR	47.1	0.7	32.7	9.3	7.7	2.6
CA	28.2	37.1	9.0	8.5	2.4	14.8
CO	31.7	44.7	12.4	6.8	1.2	3.1
CT	55.9	0.1	4.4	28.2	8.6	2.8
DE	20.6	1.1	38.1	25.0	9.8	5.4
DC	9.4	0.1	0.0	86.2	0.5	3.8
FL	35.1	1.9	17.0	19.3	22.7	3.8
GA	52.9	1.1	16.0	16.9	11.2	1.9
ID	35.4	43.7	11.1	2.9	2.4	4.6
IL	14.4	0.5	68.5	12.8	1.7	2.0
IN	21.9	0.2	60.6	13.8	1.9	1.5
IA	8.5	1.0	65.6	21.7	2.2	1.0
KS	4.2	26.2	57.9	8.5	2.1	1.1
KY	52.8	0.3	33.5	9.5	1.6	2.3
LA	28.6	0.6	22.2	11.7	29.1	7.8
ME	74.6	0.5	2.9	4.7	11.8	5.5
MD	35.9	0.6	27.3	27.4	5.2	3.6
MA	53.1	0.1	4.1	28.4	10.5	3.9
MI	37.9	2.0	25.8	13.8	17.5	3.0
MN	24.3	1.9	37.5	14.8	15.7	5.9
MS	44.3	1.0	24.9	12.8	14.2	2.8
MO	35.3	0.8	50.6	9.5	2.1	1.6
MT	22.6	52.0	12.6	6.8	3.3	2.7
NE	2.3	47.0	36.1	8.9	4.6	1.1
NV	14.8	74.4	0.9	1.4	1.1	7.4
NH	78.0	0.3	2.5	10.0	5.7	3.5
NJ	36.7	0.9	9.8	37.1	10.1	5.3
NM	23.0	68.3	2.2	2.0	1.3	3.2
NY	55.4	0.6	18.1	13.6	8.8	3.5
NC	50.1	3.7	18.0	17.7	8.7	1.8
ND	0.7	26.5	48.2	14.6	5.2	4.7
OH	30.1	0.1	49.0	17.3	2.1	1.4
OK	21.6	31.0	27.9	14.6	2.5	2.4
OR	43.8	38.8	7.7	4.2	2.6	2.9
PA	59.7	0.2	19.0	17.4	1.6	2.2
RI	49.0	0.1	2.5	32.1	12.0	4.4
SC	51.0	0.9	15.5	15.3	14.2	3.1
SD	3.5	46.5	35.1	8.8	2.3	3.8
TN	52.0	0.3	29.5	12.5	2.9	2.7
TX	18.9	42.1	20.9	11.8	4.4	1.9
UT	27.7	50.1	3.4	2.9	1.2	14.7
VT	72.2	0.1	11.7	8.0	3.9	4.1
VA	61.0	1.3	19.4	13.4	2.8	2.1

WA	44.5	23.2	16.9	7.1	3.5	4.8
WV	80.0	0.4	6.9	9.4	1.4	1.9
WI	41.2	0.6	34.3	12.4	8.0	3.6
WY	14.9	72.3	3.0	2.3	2.6	4.8
U.S.	29.4	29.5	21.9	9.7	5.2	4.3

E. Forest Land and Water Supply

Table E1. Estimates of forest land area from three sources, and associated water supply, by region of the contiguous U.S.

Region	Land area ($km^2 \times 10^{-3}$)			Water volume per year ($m^3 \times 10^{-9}$)		
	NLCD	LandFire*	FIA	NLCD	LandFire*	FIA
East	258	267	293	160	165	183
South	600	683	904	307	340	442
Midwest	296	315	328	97	101	103
Plains	134	189	178	26	30	37
West	699	811	917	295	325	378
U.S.	1987	2265	2619	884	961	1143

* LandFire/PHYS.

Table E2. Estimates of forest land area from three sources, and associated water supply, by WRR of the contiguous U.S.

Region	Land area (km^2)			Water volume per year ($m^3 \times 10^{-6}$)		
	NLCD	LandFire*	FIA	NLCD	LandFire*	FIA
1	97,980	105,238	123,589	66,091	70,810	83,174
2	145,007	147,516	158,521	77,476	78,542	83,886
3	264,771	331,894	497,827	128,821	153,737	227,183
4	99,327	109,763	135,539	37,198	40,227	49,367
5	205,187	203,601	192,979	105,850	105,407	101,505
6	61,313	64,002	66,285	41,273	43,006	44,818
7	98,801	107,951	101,987	29,497	32,053	30,878
8	67,497	76,238	116,613	33,559	37,969	59,458
9	15,009	18,112	29,596	1,874	2,319	3,951
10	119,438	126,804	126,199	27,405	29,317	31,340
11	134,520	142,336	170,062	45,094	46,070	53,016
12	65,155	114,398	87,595	11,564	15,916	18,367
13	38,097	58,741	48,218	2,328	3,054	2,824
14	83,450	91,052	105,251	10,834	11,495	12,554
15	62,771	74,959	100,324	1,920	2,011	2,745
16	56,682	68,143	67,702	4,855	5,721	6,085
17	270,762	303,389	363,501	198,404	217,644	257,156
18	101,502	120,438	127,123	59,772	65,858	74,490
U.S.	1,987,270	2,264,576	2,618,911	883,814	961,156	1,142,797

* LandFire/PHYS.

Table E3. Estimates of forest land area from three sources, and associated water supply, by state in the contiguous U.S.

	Land area (km^2)			Water volume per year ($m^3 \times 10^{-6}$)		
State	**NLCD**	**LandFire***	**FIA**	**NLCD**	**LandFire***	**FIA**
AL	70,106	77,212	99,064	41,606	45,828	58,909
AZ	44,175	52,746	77,715	1,335	1,427	2,063
AR	62,931	64,807	75,223	29,703	30,526	35,569
CA	94,712	113,519	118,534	58,537	64,772	73,276
CO	77,136	85,607	94,200	11,370	12,594	13,271
CT	6,972	6,958	7,773	4,737	4,729	5,312
DE	557	985	1,184	228	390	458
DC	16	15	31	10	9	19
FL	25,101	48,567	73,616	9,114	15,942	25,637
GA	66,679	80,017	116,178	31,015	35,818	49,855
ID	70,798	76,580	94,219	32,131	33,467	42,361
IL	21,931	21,007	16,053	7,730	7,422	5,769
IN	21,172	20,550	14,791	8,972	8,708	6,486
IA	10,079	12,353	9,479	2,935	3,529	2,855
KS	7,854	8,871	6,950	1,665	1,387	1,456
KY	54,518	55,175	51,672	27,438	27,745	25,927
LA	26,934	33,353	61,000	13,301	16,480	31,537
ME	52,764	59,102	71,175	35,586	39,680	47,850
MD	7,860	8,193	8,696	3,563	3,657	3,814
MA	9,974	10,117	12,337	6,547	6,645	8,096
MI	50,115	53,966	71,633	15,333	16,540	22,041
MN	42,324	52,319	67,442	7,840	9,971	12,760
MS	47,539	54,680	79,991	26,197	30,142	44,484
MO	66,404	63,819	59,078	24,140	23,281	21,643
MT	82,486	85,836	96,350	26,585	27,833	33,092
NE	3,984	4,520	4,234	368	338	307
NV	31,134	42,298	36,813	1,597	2,247	1,845
NH	17,942	18,484	20,395	12,438	12,808	14,095
NJ	5,517	6,925	7,377	2,996	3,730	3,923
NM	52,327	72,238	68,043	1,690	1,979	2,051
NY	67,346	67,373	75,106	41,543	41,451	46,570
NC	52,859	61,804	98,479	29,166	32,546	48,554
ND	3,037	1,365	944	93	63	52
OH	33,086	31,834	26,120	13,188	12,683	10,598
OK	38,585	39,108	62,670	10,417	10,625	15,075
OR	90,256	108,926	124,647	72,364	81,808	91,120
PA	70,203	69,811	67,924	39,509	39,365	38,578
RI	1,083	1,097	1,413	759	768	991
SC	29,331	39,679	65,511	12,243	15,872	25,392
SD	6,869	7,008	6,389	273	274	257
TN	54,861	56,743	57,214	34,175	35,425	35,851
TX	73,716	127,948	96,344	13,342	17,565	20,114
UT	54,627	59,306	67,827	4,509	4,487	4,926

VT	17,434	17,819	19,578	11,893	12,151	13,311
VA	58,881	61,103	71,854	25,652	26,609	31,220
WA	69,432	75,842	95,769	74,505	81,845	99,402
WV	50,724	50,131	53,964	27,135	26,772	28,821
WI	51,240	59,069	63,173	16,446	18,867	20,421
WY	31,656	37,794	42,741	9,896	12,355	14,783
U.S.	1,987,270	2,264,576	2,618,911	883,814	961,156	1,142,797

* LandFire/PHYS.

F. Mean Annual 1981-2010 Water Supply and Land Area of the National Forest System

Table F1. National Forest System ownership land area, and associated mean annual water supply volume, by NFS region in the contiguous U.S.

NFS region	Land area ($km^2 \times 10^{-3}$)*	Water volume per year ($m^3 \times 10^{-9}$)
1. Northern	103	45
2. Rocky Mountain	91	19
3. Southwestern	83	3
4. Intermountain	129	33
5. Pacific Southwest	82	42
6. Pacific Northwest	101	87
8. Southern	55	30
9. Eastern	49	20
U.S.	693	280

* Land ownership taken from the November 2015 U.S. Forest Service Surface Ownership Parcels database.

Table F2. National Forest System land area according to two area designations, and associated mean annual water supply volume, by state in the contiguous U.S.*

State	Land area ($km^2 \times 10^{-3}$)		Water volume per year ($m^3 \times 10^{-9}$)	
	Proclamation	**Ownership**	**Proclamation**	**Ownership**
AL	5,160	2711	3,270	1717
AZ	47,168	45343	1,462	1414
AR	13,884	10494	7,407	5642
CA	97,873	84034	51,719	43565
CO	69,220	58684	14,265	13364
CT	0	0	0	0
DE	0	0	0	0
DC	0	0	0	0
FL	5,170	4842	1,989	1854
GA	7,175	3514	5,523	2874
ID	86,756	82841	38,650	37442
IL	3,574	1232	1,773	592
IN	2,546	824	1,189	388
IA	0	0	0	0
KS	520	442	12	11
KY	8,209	3311	4,361	1774
LA	3,775	2463	1,870	1230
ME	314	219	232	160
MD	0	0	0	0
MA	0	0	0	0

MI	18,838	11623	5,912	3635
MN	17,960	11509	3,250	2076
MS	9,492	4823	5,325	2741
MO	11,978	6094	4,892	2520
MT	76,677	69531	28,774	26862
NE	2,252	1913	54	47
NV	25,180	23286	2,217	2074
NH	3,300	3028	3,043	2859
NJ	0	0	0	0
NM	42,153	37353	1,540	1443
NY	84	66	36	29
NC	11,887	5073	10,122	4570
ND	8,964	4460	128	67
OH	3,456	988	1,515	428
OK	3,198	1623	816	694
OR	70,612	63776	48,163	45053
PA	2,901	2079	1,873	1341
RI	0	0	0	0
SC	5,443	2563	2,519	1186
SD	13,577	8771	387	277
TN	4,929	2919	3,039	1865
TX	9,013	3663	2,136	902
UT	37,044	32914	4,901	4244
VT	2,544	1660	2,255	1516
VA	12,837	6748	5,571	2907
WA	40,074	37704	44,200	41944
WV	7,579	4226	5,021	2755
WI	8,021	6170	2,709	2082
WY	43,938	37569	12,398	12202
U.S.	845,276	693,087	336,518	280,349

* NFS proclamation boundaries taken from the 2005 Federal Lands of the United States database of the National Atlas of the U.S. NFS land ownership boundaries taken from the November 2015 U.S. Forest Service Surface Ownership Parcels database.

Table F3. National Forest System ownership land area, and associated mean annual water supply volume, by unit of the NFS in the contiguous U.S.*

NFS unit	Area (km2)#	Water volume per year (m^3 x 10^{-6})
Allegheny NF	2079	1341.2
Angeles NF	2688	474.0
Apache-Sitgreaves NFs	8160	235.8
Arapaho and Roosevelt NFs	5686	1399.3
Ashley NF	5578	900.6
Beaverhead-Deerlodge NF	13728	3776.5
Bighorn NF	4473	1271.9
Bitterroot NF	6453	3106.5
Black Hills NF	5062	197.6
Black Kettle NG	134	2.7
Boise NF	8918	3864.2
Bridger-Teton NF	13842	5558.8
Buffalo Gap NG	2648	54.1
Butte Valley NG	79	3.1
Caddo NG	277	91.5
Caribou-Targhee NF	11538	3528.0
Carson NF	6039	304.8
Cedar River NG	27	0.5
Chattahoochee-Oconee NFs	3510	2870.5
Chequamegon-Nicolet NF	6166	2081.1
Cherokee NF	2660	1719.2
Chippewa NF	2719	490.2
Cibola NF	6542	97.4
Cimarron NG	442	10.7
Cleveland NF	1724	95.9
Coconino NF	7493	306.9
Columbia River Gorge NSA	333	414.1
Colville NF	4464	1645.6
Comanche NG	1799	16.4
Coronado NF	6956	159.8
Crooked River NG	703	50.5
Curlew NG	302	10.2
Custer NF	4787	1173.4
Dakota Prairie Grasslands	3	0.05
Daniel Boone NF	2878	1535.8
Deschutes NF	6524	2421.5
Dixie NF	6604	348.9
Eldorado NF	2458	1997.7
Fishlake NF	6904	501.6
Flathead NF	9767	5747.9
Fort Pierre NG	846	29.1
Francis Marion and Sumter NFs	2559	1183.9
Fremont-Winema NFs	9121	1767.3

Gallatin NF	7512	3630.3
George Washington and Jefferson NF	7252	3095.0
Gifford Pinchot NF	5493	9529.7
Gila NF	13232	451.0
Grand Mesa, Uncompahgre and Gunnison NFs	11995	2437.6
Grand River NG	626	10.0
Green Mountain and Finger Lakes NFs	1726	1544.6
Helena NF	3976	760.8
Hiawatha NF	3633	1200.3
Hoosier NF	824	387.9
Humboldt-Toiyabe NF	25314	2983.3
Huron-Manistee NF	3961	1145.8
Idaho Panhandle NFs	10109	5924.6
Inyo NF	8029	1760.1
Kaibab NF	6317	231.2
Kiowa NG	583	3.0
Kisatchie NF	2463	1230.3
Klamath NF	6008	3767.0
Kootenai NF	9078	3706.6
Lake Tahoe Basin Management Unit	615	263.2
Land Between the Lakes NRA	693	387.3
Lassen NF	4668	2668.4
Lewis and Clark NF	7574	1979.4
Lincoln NF	4433	120.4
Little Missouri NG	4150	58.4
Lolo NF	8938	3964.9
Los Padres NF	7200	1058.9
Lyndon B. Johnson NG	467	44.3
Malheur NF	6969	1406.7
Manti-La Sal NF	5421	630.5
Mark Twain NF	6094	2520.2
McClellan Creek NG	6	0.2
Medicine Bow-Routt NF	9468	2652.7
Mendocino NF	3706	3208.9
Midewin National Tallgrass Prairie	74	22.9
Modoc NF	6796	729.4
Monongahela NF	3725	2567.8
Mt. Baker-Snoqualmie NF	7129	12369.1
Mt. Hood NF	4111	5287.4
National Forests in Alabama	2714	1718.7
National Forests in Florida	4839	1852.7
National Forests in Mississippi	4823	2741.4
National Forests in North Carolina	5077	4572.3
National Forests in Texas	2588	763.5
Nebraska NF	1046	28.0
Nez Perce-Clearwater NF	15926	11240.9
Ochoco NF	2484	422.4
Oglala NG	874	18.9

Okanogan-Wenatchee NF	16187	12496.1
Olympic NF	2560	5241.0
Ottawa NF	4034	1290.5
Ouachita NF	7226	4011.9
Ozark-St. Francis NF	4696	2320.9
Pawnee NG	843	11.6
Payette NF	9346	4591.5
Pike and San Isabel NFs	8922	1055.0
Plumas NF	4875	3216.4
Prescott NF	5087	153.9
Rio Grande NF	7434	1761.9
Rita Blanca NG	381	3.2
Rogue River-Siskiyou NFs	6956	11550.5
Salmon-Challis NF	17620	5574.7
San Bernardino NF	2723	420.8
San Juan NF	7546	1748.9
Santa Fe NF	6256	460.5
Sawtooth NF	8541	2749.5
Sequoia NF	4511	1055.0
Shasta-Trinity NF	8613	7064.4
Shawnee NF	1158	569.2
Sheyenne NG	284	8.1
Shoshone NF	9871	3405.8
Sierra NF	5327	3043.6
Siuslaw NF	2539	4134.8
Six Rivers NF	4722	5603.4
Stanislaus NF	3636	2681.3
Superior NF	8790	1586.1
Tahoe NF	3402	3202.7
Thunder Basin NG	2534	32.0
Tonto NF	11601	332.6
Uinta-Wasatch-Cache NF	8725	1858.8
Umatilla NF	5680	1208.4
Umpqua NF	3991	4037.2
Wallowa-Whitman NF	9723	3427.5
Wayne NF	988	428.0
White Mountain NF	3247	3018.7
White River NF	9259	3171.3
Willamette NF	6840	9935.6
U.S.	693,087	280,349

* NF = National Forest; NG = National Grassland; NRA = National Recreation Area; NSA = National Scenic Area.

Land ownership taken from the November 2015 U.S. Forest Service Surface Ownership Parcels database.

G. Mean Annual 1981-2010 Water Supply and Land Area of Designated Wilderness Areas

Table G1. Wilderness land area and associated mean annual water supply volume, by federal agency and state of the contiguous U.S.

Region	Land area (km^2)*					Water volume per year ($m^3 \times 10^{-6}$)				
	FS	BLM	NPS	FWS	Total	FS	BLM	NPS	FWS	Total
AL	171	0	0	0	171	111	0	0	0	111
AZ	5,344	5,723	1,748	5,515	18,330	155	44	14	21	234
AR	470	0	140	9	619	256	0	65	5	326
CA	20,711	16,472	24,658	39	61,880	10,545	830	4,341	0	15,716
CO	12,876	834	1,414	10	15,134	5,173	50	643	4	5,870
CT	0	0	0	0	0	0	0	0	0	0
DE	0	0	0	0	0	0	0	0	0	0
DC	0	0	0	0	0	0	0	0	0	0
FL	300	0	3,223	98	3,622	135	0	966	40	1,141
GA	474	0	0	1,433	1,906	455	0	0	613	1,068
ID	17,045	2,278	174	0	19,497	8,882	122	15	0	9,018
IL	115	0	0	17	133	57	0	0	10	67
IN	51	0	0	0	51	23	0	0	0	23
IA	0	0	0	0	0	0	0	0	0	0
KS	0	0	0	0	0	0	0	0	0	0
KY	70	0	0	0	70	36	0	0	0	36
LA	35	0	0	13	49	17	0	0	8	24
ME	45	0	0	30	76	32	0	0	23	55
MD	0	0	0	0	0	0	0	0	0	0
MA	0	0	0	0	0	0	0	0	0	0
MI	378	0	719	109	1,206	127	0	240	36	403
MN	4,430	0	0	29	4,459	743	0	0	3	746
MS	25	0	0	0	25	15	0	0	0	15
MO	260	0	0	32	292	106	0	0	14	120
MT	13,668	26	0	258	13,952	8,352	1	0	48	8,402
NE	32	0	0	19	50	0	0	0	1	1
NV	4,599	8,439	933	0	13,970	575	258	9	0	842
NH	560	0	0	0	560	661	0	0	0	661
NJ	0	0	0	35	35	0	0	0	16	16
NM	5,793	716	227	163	6,899	439	6	3	1	449
NY	0	0	0	0	0	0	0	0	0	0
NC	416	0	0	34	450	375	0	0	17	392
ND	0	0	122	39	161	0	0	1	1	2
OH	0	0	0	0	0	0	0	0	0	0
OK	64	0	0	40	104	40	0	0	2	42
OR	9,034	1,016	0	20	10,070	10,319	285	0	35	10,639
PA	36	0	0	0	36	23	0	0	0	23

RI	0	0	0	0	0	0	0	0	0	0
SC	68	0	61	96	225	32	0	25	38	96
SD	55	0	250	0	305	2	0	3	0	5
TN	269	0	0	0	269	188	0	0	0	188
TX	156	0	187	0	343	51	0	3	0	54
UT	3,129	1,066	503	0	4,698	962	16	12	0	991
VT	408	0	0	0	408	392	0	0	0	392
VA	556	0	333	0	889	262	0	148	0	410
WA	11,073	29	7,018	6	18,126	15,004	2	15,092	12	30,110
WV	482	0	0	0	482	345	0	0	0	345
WI	191	0	0	0	191	62	0	0	0	62
WY	12,418	0	0	0	12,418	5,492	0	0	0	5,492
U.S.	125,809	36,598	41,711	8,044	212,162	70,447	1,614	21,582	946	94,588

* Land area from the database of the Wilderness Institute at the University of Montana's College of Forestry and Conservation, October 2015.